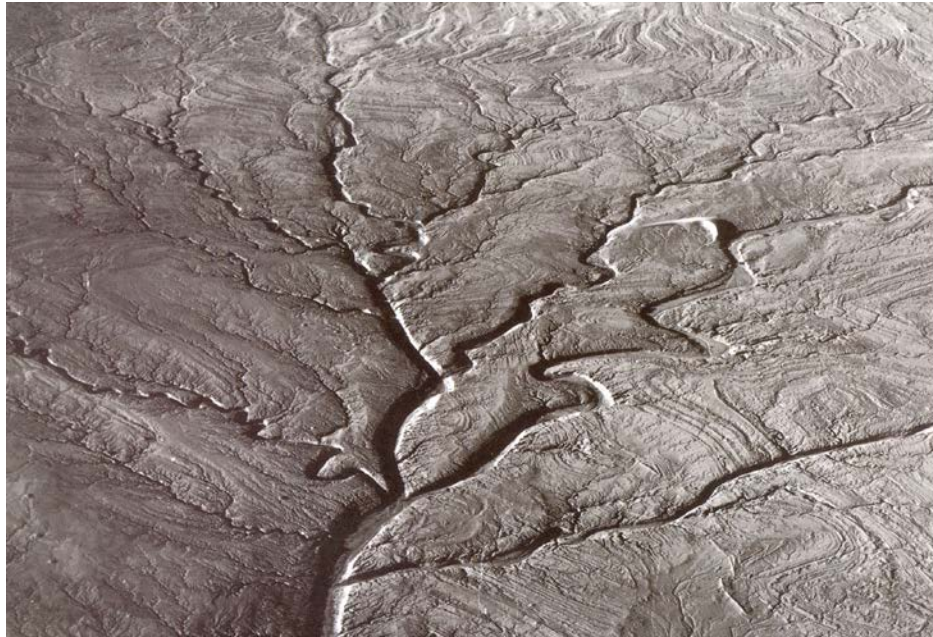


Water Distribution Systems



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Whole Systems Design

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All “municipal water systems” are embedded within local watersheds; all local watersheds are embedded within larger continental drainages; and all continental drainages are embedded within the greater hydrological cycle of the planet.

The local watershed is a *natural* system, a dendritic branching pattern that continually funnels and focuses flow into ever fewer, larger, and more inclusive channels culminating in the single flow of a river back to its source, the sea. Other natural systems that use this dendritic branching pattern are: 1) the circulatory system of the body, originating in capillaries and funneling and focusing spent blood flow into ever fewer, larger, and more inclusive veins culminating in a single flow back to their source, the heart; or, conversely, the arterial network that distributes fresh, oxygenated blood from the source back to the individual capillaries; 2) the nervous system of the body, originating in individual nerve cells and funneling and focusing electrical impulses back to the brain; 3) the vascular system of plants that funnels and focuses photosynthetic sugars from individual cells back down to the roots; and, conversely, draws minerals and nutrients from the roots back up into the branching pattern of the plant and into individual cells; and, 4) the electrical surge of a lightning bolt.

The “municipal water system” is a human-constructed system that attempts to mimic the dendritic branching pattern of natural systems. In this case, water is taken from a source and then distributed through ever finer and more numerous channels until it eventually reaches individual taps and faucets. Other human constructed systems that use this pattern are: 1) road systems that funnel traffic flow between large volume highways and individual parking spaces; 2) flow charts, Boolean algebra, and other graphic decision-making tools; 3) electronic schematics, especially of the digital computer kind; 4) distribution of electrical power from main generating stations to substations to individual outlets; 5) phone trees and rumor dispersal; and, 6) the phylogenic tree diagram of biological evolution.

The dendritic branching pattern is used to focus or distribute *flow* in the most efficient, precise manner possible. Two other similar patterns are the ‘network’ and the ‘hierarchy’ – and Fritjof Capra in his *Web of Life* (p. 35) makes an initial attempt to distinguish these two. It seems that the hierarchy is an idealized human construct that may not have an exact corollary in Nature, despite the emphasis of its use in Systems Theory. (This is a very sensitive issue, especially to ecofeminists, and I hope to clarify it

as my education progresses). A hierarchy may attempt to provide an idealized order or rank to a branching pattern, as in the five-tier grading system of streams according to their size and position in the overall drainage pattern. I believe that an idealized democracy is envisioned to behave as a dendritic branching pattern, whereby individual opinions are channeled back to a single decision-making body, and each person theoretically has an input on each issue. In practice, however, a democracy behaves more like a strict hierarchy, and is not efficient at all. Perhaps this is more a reflection of *representative* democracy, a compromise; the inefficiencies, lethargy, and inertia of representative democracy are also a matter of *scale*, another vital parameter when defining systems.

'Networks' also seem to be able to distribute rapidly but they are unable to focus, and I'm not quite sure that what they are distributing is flow – it seems more like the distribution of discrete units into numerous decentralized and apparently unrelated channels. Networks communicate horizontally while branching patterns and hierarchies communicate vertically. These concepts will also be clarified as my education progresses.

In the natural system that is a watershed, water behaves as it will, according to its nature: It flows and whirls and spirals and eddies and gurgles and seeps and drips and splashes and cascades and pools and evaporates and rushes and, finally, gently meanders as it makes its way back to its source. Water behaving in its natural context is alive; it performs many functions for the ecosystems it passes through: It filters and cleanses and oxygenates and dissolves and reflects and concentrates and erodes and liquefies and nourishes and stores and communicates and responds to cosmic vibrations and, generally, enhances the proliferation of Life at every turn.

In the human-constructed system that is the "municipal water system," however, water is controlled and manipulated and forced to behave contrary to its nature: It is channeled through long, linear canals, conduits and pipes where it loses its spiraling vitality; it is covered and concealed and hidden and so loses its relationship with earth, air, fire, and cosmos; it is mechanically pumped, introducing discordant vibrations into its body; it is chemically treated, losing its innate structure; and, it is stored in tanks and cylinders where it loses its form and becomes limp and stale. The "municipal water system" may attempt to mimic the dendritic branching pattern of a natural system but something is lost in the process. The human-constructed system applies so much force, control, stress, and, unfortunately, ignorance that the flow through the system is altered, weakened and rearranged, losing its essence and becoming lifeless. This is what happens when living 'things' are treated as commodities.

Human-constructed systems in general tend to be excessively rigid, resisting change, and by definition are entropic, destined to decay. Natural systems are flexible – they evolve through time and adjust to and accommodate change, and, by definition, are negentropic, increasing in productivity and diversity as they grow.

Imagine: somewhere, everywhere, here and there under the streets of Seattle are networks of concrete pipe, iron mesh, steel girders, toxic remnants of copper, lead, and mercury mistakes, old garbage dumps, oil and gas spills, and traces of a former city – now home to rats, roaches, and disembodied spirits. In one direction through this subterranean network raw sewage is flowing and in the other direction treated water. Add the inevitable earthquake and there will be catastrophe – the rigid underground network that is a component of the “municipal water system” will break and fracture, and somebody will have to go down into the mess to fix it. Even now it is decaying.

Somewhere, everywhere under the streets of Seattle, even beneath the buried city, there was once a natural watershed nourishing and generating many living systems and life-forms, including an indigenous human culture. That living watershed was buried under the rubble of industrial progress and on top of its still faint geomorphology has grown an asphalt aberration, an abstract human construction of squares and avaricious competition and linear projections, an intrusive social metasystem called ‘civilization’ whose function is the substitution, or at least control and domestication, of wild Organic Life. Civilization is certainly a system, a group of interacting parts forming a collective whole, but it is not a *living* system. Living systems have well-defined boundaries; they have limits to their growth – scale – that are defined by their functions within their greater environmental context; and, living systems have a synergy of mutually-reinforcing relationships with their suprasystems and subsystems. Civilization lacks all these characteristics so it is not a living system – it more accurately belongs to the class of systems we call machines, incorporating live human beings into its structure.

Machines are comprised of subsystems as well: Civilization is comprised of nation-states, which are comprised of metropolises, which are comprised of cities, which are comprised of many subsystems including “utility systems.” Subsumed under “utility systems” are electrical systems, natural gas systems, waste disposal systems, and “the municipal water system.” Each of these subsystems of civilization is also constructed as a machine, a “system of rigid bodies formed and connected to alter, transmit, and direct applied forces in a predetermined manner to accomplish a specific objective, such as the performance of useful work” (American Heritage). Accordingly, the “municipal water system” is a *mechanical* system, merely an *approximation* of a natural system: it is not the most beneficial way for humans to meet their essential water needs.

In order for these mechanized subsystems of civilization to run most efficiently, it is necessary that the live human beings acting as construction, control, and repair units also be mechanized. Live human beings acting under such conditions soon grow apathetic, then aggressive. They eventually lose interest in their standardized, regimented routine and can only be kept in place, performing their mechanized function, by coercion or threat of loss. Strict hierarchies are necessary to enforce control to keep the machine running. Water, a fundamental element of Life, whose natural, free-flowing functions and processes spontaneously enhance the proliferation of Life, can easily become polluted, tainted, and poisoned when forced through such stressed and antagonized systems. These systems are life-draining; they extract and rob the living essence from the water as they extract and rob the living essence from their human labor units.

Imagine: just one-hundred twenty years ago, Life proliferated along the shores of the Great Sound in the location that would eventually become known as 'Seattle.' Then, within a very, very short time, an alien thought-form swept through and completely transformed the place. The alien thought-form had as its directive, "conquer, subdue, exploit, and extract." The people who embodied the thought-form had internalized its rationally objective, though life-compromising ideology. They hurriedly constructed a built environment that would efficiently instrument the directive. In their haste, they made many, many mistakes and overlooked or discarded many of the accumulated wisdoms of the past – obviously, they thought they were on a better, superior ride. Now, with hindsight, we can judge that their joy-ride was a temporary aberration; it cannot be continued into the indefinite future. Unfortunately, the mess they created and left behind – the sterile, gray, mechanical debacle of civilization – is now the built environment we must inhabit as we guide our evolution back to the warm, loving embrace of a vibrant, giving, living Nature.