STRAWBERRY CREEK I

THE MAKING OF AN URBAN STREAM, 1860–1960

Robert Charbonneau

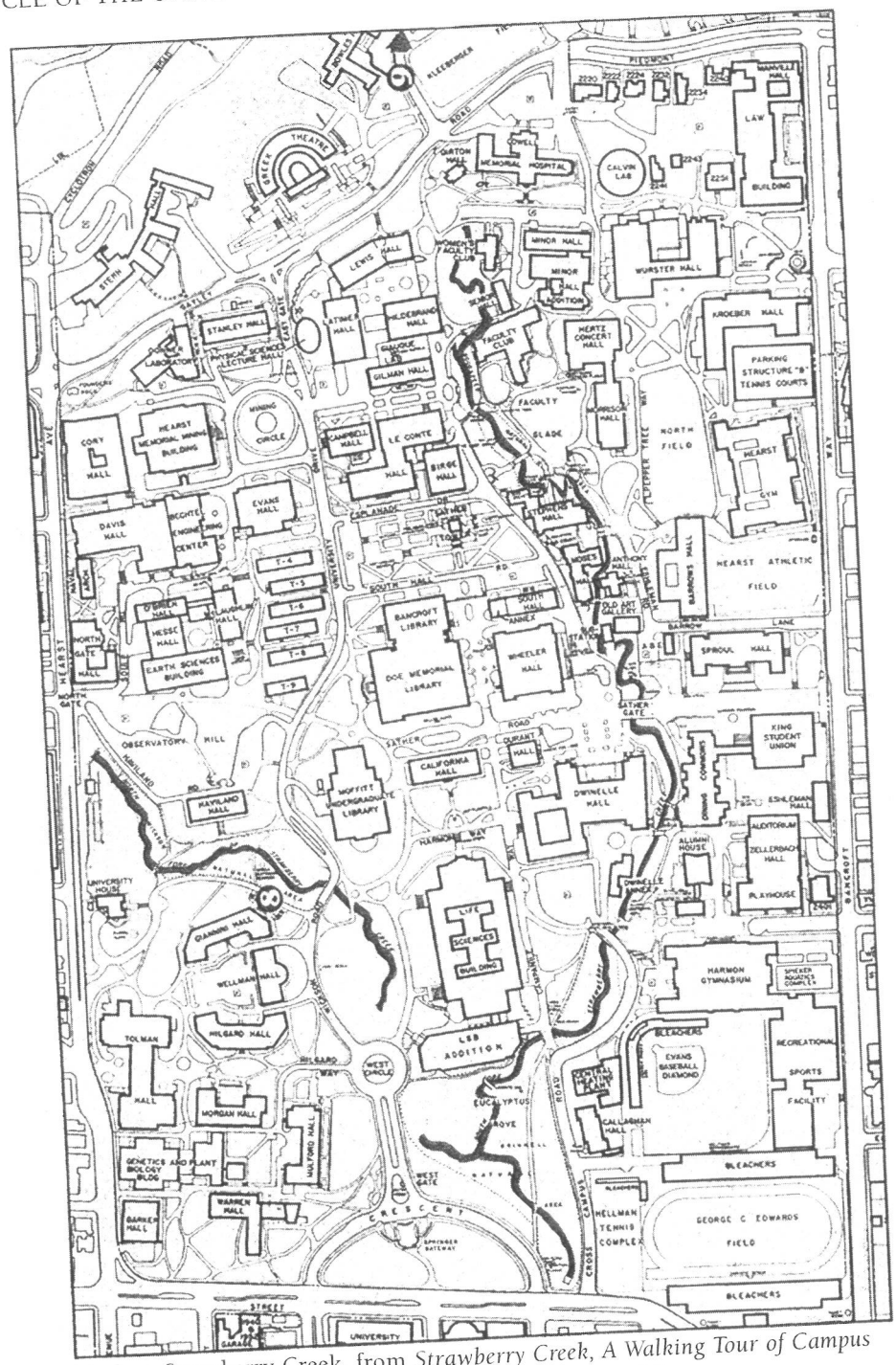
THE HISTORY OF STRAWBERRY CREEK is integrally linked to the founding of the Berkeley campus site and the subsequent development of the campus and its upper Strawberry Canyon watershed drainage area. Since its inception, the campus has taken a thoroughly utilitarian approach to dealing with the creek—first exploiting it as the primary water supply upstream and sewage disposal downstream, and soon thereafter attempting to get it under control in the name of progress. For over a hundred years as the campus grew, the creek was seen as an obstacle and hazard to overcome, and yet, oddly juxtaposed to this pragmatic view were romantic undercurrents that focused solely on Strawberry Creek's scenic amenities. Until recently, there were no indications that the creek was appreciated or even considered in an ecological or environmental context.

Strawberry Creek is a classic case of the environmental impacts of urbanization and human modification of the landscape. It serves to illustrate the vicious cycle of trying to re-engineer natural systems, only to find these efforts prove both counterproductive and destructive and inevitably lead to increasingly complex and expensive engineering solutions that must continue in perpetuity at the expense of ecological integrity. The creek's history is filled with such ironies, none more poignant than the harnessing of the creek for its own demise during the construction of the stadium in the 1920s.

The story begins with the native Huchiun peoples, who in stark contrast to the pioneers that followed, lived as an integral part of nature, rather than as conquerors destined to transform their surroundings into "civilization." What was for these peoples a small, natural, coastal stream would be transformed into an artificially engineered urban creek. Finally, until the campus changed its ambivalent attitude, Strawberry Creek would remain just another neglected and degraded urban stream.

Prior to the arrival in the Bay Area of the Spanish explorers and other pioneers in the late 1700s, native peoples of the Huchiun-Ohlone group occupied the Strawberry Creek watershed for several millennia. Living in harmony with the creek, they maintained some temporary habitation sites in lower Strawberry Canyon. The only remaining signs of their long presence are middens (refuse deposits) along the creek on the central campus. These upland sites are related to the massive shellmounds located along the former Berkeley bay shore (Spenger's parking lot off University Avenue at Third Street), which date back three to four thousand years. The Huchiun probably used the area of Strawberry Creek for fishing, hunting, and terrestrial food gathering before returning to the village sites at the shellmounds.[1] The Huchiun also actively managed the landscape by controlled burning of grasslands and underbrush to facilitate acorn gathering and the growth of seed-bearing annuals.

The campus and hill area appeared as an open oak woodland and grassland filled with perennial bunch grasses and herbaceous flowering plants. Tree cover was generally limited to the narrow creek corridors, with strips of riparian vegetation lining the channels from the hills down through the alluvial flatlands to the bay. Salmon and trout spawned in the larger perennial reaches of the streams. Legend has it that the Strawberry Creek got its name from the abundant native vines once found along its canyon banks.



Modern Strawberry Creek, from *Strawberry Creek, A Walking Tour of Campus Natural History* (University of California at Berkeley, 1990).

In March 1772, a Spanish expedition led by Lieutenant Don Pedro Fages and Father Juan Crespí stopped for the night along the banks of Strawberry Creek—a commemorative plaque is located just upstream of Oxford Street—and there Father Crespí described the beauty of the Golden Gate vista. Spanish explorers named the East Bay "Contra Costa," "opposite coast." In the early 1800s, the peaceful Huchiun peoples having been moved in the

1790s to Mission Dolores, the East Bay was partitioned into land grants by the last Spanish and first Mexican governor of California. The boundaries of these tracts were often delineated by streams because they were the most obvious landscape features. The Rancho San Antonio tract, for instance, was deeded to Don Luís María Peralta in 1820 and encompassed the present cities of Albany, Berkeley, Emeryville, Alameda, Oakland, Piedmont, and San Leandro. Peralta introduced cattle into the area, which became vast open pastureland. In 1842, Peralta divided the rancho among his four sons, and gave his son José Domingo the northernmost area, now consisting of Berkeley and Albany.

The gold rush of 1849 opened the East Bay to widespread settlement. Disappointed miners returned from the Mother Lode in the early 1850s to squat and begin farming on Peralta's lands. José Domingo Peralta resisted the first squatters but could not maintain control over his desirable land. In 1853, Peralta sold off most of his land, and the next year Orrin Simmons, a Yankee sea captain turned farmer, acquired squatter's rights to 160 acres of land south of Strawberry Creek (between the creek and the Clark Kerr Campus and roughly east of College Avenue). In 1857 he obtained full title and purchased two more tracts of land to the north, giving him ownership of 700 acres, including the future site of the upper campus and the sites where the Greek Theatre and stadium are now located.

Up until this time, the creek likely remained relatively undisturbed except for stream bank erosion and sedimentation resulting from cattle grazing in and below Strawberry Canyon. Squatters had transformed the campus area landscape into pastureland and later into open fields of grain. An 1885 article reminisces about the campus site and creek prior to development:

> There were no roads through that portion now known as the University grounds, only cattle-paths to guide one through the profusion of poison oak and other tangled vines, that twined themselves about numberless oak trees. Our fair University site formed a part of a most desirable cattle range, and the romantic walks by the winding creek served a very practical purpose indeed. And the creek, although its course has not been changed, is altered in other respects. There were no bridges over it, only planks thrown loosely across, and the water-bed could not be reached except where boys or cattle had made paths down its steep, slippery and brush-covered banks.[2]

Strawberry Creek and its watershed were soon to be changed forever, as the trustees of the College of California searched for a new campus site in 1856-57. One of the essential site selection criteria was the availability of a reliable potable water supply. The trustees had initially rejected the Berkeley site in 1856 because Strawberry Creek was believed insufficient to supply campus water needs, but they reconsidered the following year at Simmons' urging. Simmons was a friend of influential Professor Henry Durant, who became the university's first president in 1870; Simmons would later make a handsome profit on the sale of his ranchland to the college. So during 1857 the small creek and its canyon watershed were more closely scrutinized as a potential water supply.

> The quantity of water in Strawberry Creek was noted through the dry season. The springs in the hills were explored. Examination was made to ascertain whether there were other sources of water supply available in the hills. It was never intended to do so foolish a thing as to locate a College, in this State of long, rainless summers, on any site, without an abundance of pure, flowing water. During the year it was satisfactorily ascertained that a

copious supply could be obtained, back in the higher hills. When this fact was finally settled, the opinion of the Trustees and friends of the college seemed to gravitate towards this spot as the permanent site of the College . . . The site, as contemplated at that time, consisted of one hundred and forty acres. It was to include both banks of Strawberry Creek, and their fine bordering of oaks, sycamores, bay-trees, and a plentiful growth of evergreen shrubbery.[3]

College Homestead Association Tract, 1866, project for College of California.

In 1858, the trustees voted unanimously to adopt Berkeley as the campus site and subsequently purchased five tracts of land immediately west of Simmons's ranch. However, problems soon arose concerning water rights to Strawberry Creek and its canyon springs above the campus property. This led to the 1864 incorporation of the College Homestead Association, which subdivided 128 southside lots (160 acres) for subsequent sale in order to raise funds to purchase Simmons's lower canyon ranchland, thereby securing water rights to the creek.[4]

The College Water Company was incorporated in 1867 to develop waterworks to supply water to the campus and homestead tract. A brick reservoir was built in the hills (at the foot of what is now Panoramic Way above the stadium). It was supplied by a wooden flume in lower Strawberry Canyon that collected water from various canyon springs, located in the hills around the present Lawrence Berkeley National Laboratory. In addition, water was piped from the college-owned Heywood Springs, located about a half mile north-northeast of the campus, in the vicinity of what is now Fire Station #7 on Shasta Road. Wrought iron and galvanized pipes distributed the water to the campus and homestead tract. The college also secured additional water rights to Wildcat Creek (on the east side of the hills in what is now Tilden Park) to ensure an adequate water supply:

> The foundation was indeed laid for securing such a water supply as had from the beginning been considered the only thing wanting to make the College site very nearly perfect for its purpose. With all its other fine advantages, as before remarked, it would never have been chosen as the location of a great institution of learning by the Board of Trustees without a more copious and reliable water-supply than that furnished by Strawberry Creek alone. They would have felt that they never could have excused themselves to the generations of coming time for placing such an institution as a college where there was not a copious flow of pure, fresh water. . . . But when this last source of supply was assured, the College site was judged to be possessed of every advantage as the permanent location of the College and the College town. Plans could now be made for improvement of grounds and building lots without fear of drought or scarcity of water.[5]

The harnessing of Strawberry Creek's stream flow was begun in earnest. As soon as the initial waterworks were substantially completed in August 1867, the college hosted a public celebratory "rural picnic" on the grounds to inaugurate its new water supply system:

> When the water was first turned from the reservoir into the pipes, and went up in spray over a hundred and fifty feet pressure, at various points on the homestead tract and College site, playing jets fifty or seventy-five feet in the air, it was a sight novel and animating enough. It was a demonstration that waterworks thus begun could be carried to any desired extent. The water could be conducted down wherever it was wanted, all over the plain, and to Oakland itself if it should appear that it could be done to advantage. It would first be for the use of the College, on its own grounds, not only for domestic purposes, but for irrigation, for security against fire, for fountains, and ornamentation generally, and then for the supply of the public at a fair rate.[6]

However, this rosy outlook proved to be overly optimistic. The thirst for water of the growing campus and environs continued to outstrip the limited supply, especially during the dry season. The campus reservoir ran dry several times in 1877 and additional small dams were eventually built in Strawberry Canyon in 1897 and again in 1904. A new 300,000-gallon water tank was built in the canyon in 1898 where Witter Field above the stadium is today, but complaints about the inadequacy of the campus water supply system persisted until a high pressure water main was finally completed along Piedmont Avenue in 1926.

While much of the water was being drained out of the creek, it was simultaneously being replaced by wastewater. The first reports of problems with sewage contamination date back to 1877. A city sanitary sewer system was not even contemplated until 1883, and not actually built on campus until the 1890s.[7] The mainline trunk sewer through the middle of campus was not completed until 1906.[8] Strawberry Creek served as an open sewer for decades until this infrastructure was completed. In 1877:

> At present unless something is done to improve the drainage from some private homes and boarding houses, the health of the neighborhood will be seriously impaired . . . let him take a twilight stroll along the windings of Strawberry Creek and from afar, will be scent that Berkeley's balmy zephyrs are freighted with the doubtful odor of essences extraneous. Just as we were

> taking refuge from the scented air at Bachman's, a freshman was giving a gentleman directions to the University buildings. Said he, "Stranger, go up this creek as long as you can hold your breath, and turn left."[9]

Serious sewage problems persisted until at least 1895, but not without criticism directed at both the adverse aesthetic impacts and threat to public health, the *Berkeleyan* commented:

> In moderately civilized communities, it is conceded that the use of an open water-course as a sewer is detrimental to the public health and destructive of natural beauty. Yet here at the seat of the highest learning offered by the State, where civilization may be considered as having one of its most advanced positions, we have the above shocking state of affairs. Leaving out of consideration the unsightly appearance of sewer-begrimed water, and filthily discolored banks, the effect upon the health of those living near its borders, as well as of the students and faculty working in laboratories at its very brink, should raise public opinion to the extent that it would be impossible for anyone to make use of Strawberry Creek as an easy means of removing sewage. The University of California should be the first to cease, and should use its every endeavor towards keeping Strawberry Creek what it naturally is, one of nature's means of preserving the beauty of the grounds through which it flows.[10]

Three forks of Strawberry Creek meandered through the central campus until the early 1880s. The meager middle fork joined the South Fork just north of Campanile Way near the corner of the Life Sciences Building Annex. It then ran northeasterly under the Valley Life Sciences Building, and split into two tiny branches with headwaters between California Hall and Durant Hall near Campanile Way, and on the north side of the central glade east of Haviland Hall around the base of Observatory Hill. In 1882, the middle fork was summarily filled in and graded to create a dry level area for a cinder running track. This relatively flat, open portion of the central campus was considered the most suitable place for the large track (now occupied by the Life Sciences Building Annex).[11] The Eucalyptus

The creek near Oxford Street, 1893.
University Archives (UARC PIC 200:2).

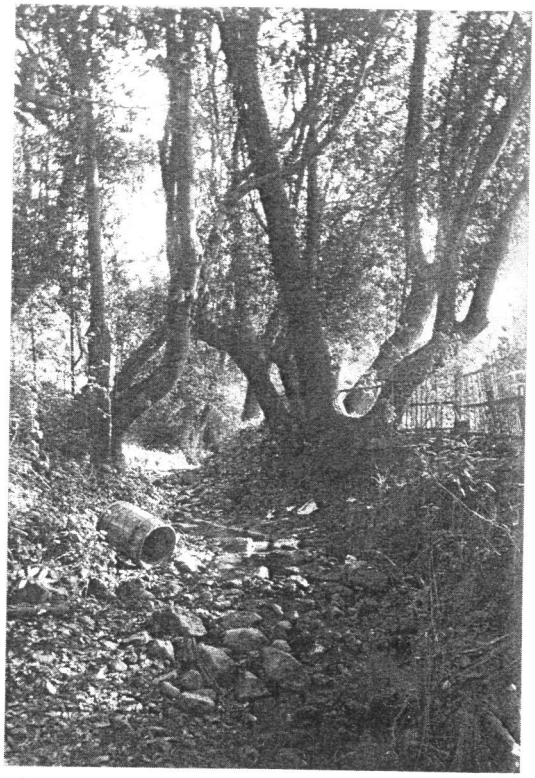
Grove was then planted to shelter the track from the strong prevailing westerly winds off the bay.

As additional ranchland was cleared in the canyon in the late 1800s, storm water runoff and sedimentation also increased. As a natural equilibrium response to greater winter flows and sediment loading, the creek channel tended to both widen and incise (deepen) to accommodate the heavier load. The first of many rock check dams was installed in 1882 in an attempt to stop the streambed incision which inevitably led to stream bank undercutting and subsequent collapse. The dams would serve as "grade control structures," preventing the streambed from deepening in the vicinity of the dams and raising the upstream bed profile:

> Workmen of the grounds have been engaged in improving the creekbed, and making provisions for winter freshets. A few years ago the frightful gully in the creek did not exist. Prof. Le Conte explains this sudden eating away as a result of the clearing off the country, and thereby increasing the erosive power of the winter rains. Five dams have been constructed in order to prevent any further cutting away, and it is hoped that in the future no further damage is done.[12]

Of course, this was a vain hope as additional development in the watershed increased the winter storm water runoff into the creek from impervious surfaces such as roads and buildings. Only one month after these first check dams were installed, it was noted that "trees near the experimental grounds (Main Branch upstream of Oxford Street) are falling into the creek. The earth was washed away by the water, causing some lofty tumbling."[13] The first shots had thus been fired in the never-ending battle to control the natural erosive forces of Strawberry Creek, an engineering struggle that continues to this day. The Civilian Conservation Corps built additional check dams in Strawberry Canyon in 1934, and more were added there in 1941. Eventually, about sixty check dams would be installed along the central campus to prevent streambed downcutting and bank erosion.

The battle escalated as check dams proved insufficient to stem the channel erosion, and it soon became necessary to armor the streambanks with riprap in the early 1900s to prevent bank erosion and collapse. "In anticipation of heavy rainfall this winter, the creek just west of the heating plant [South Fork behind the old art gallery building] is being solidly embanked with broken rock and concrete." The *Daily Californian* reported in 1904: "Last winter the creek was badly washed out at this sharp turn and proper embanking has become necessary to save adjoining land."[14]

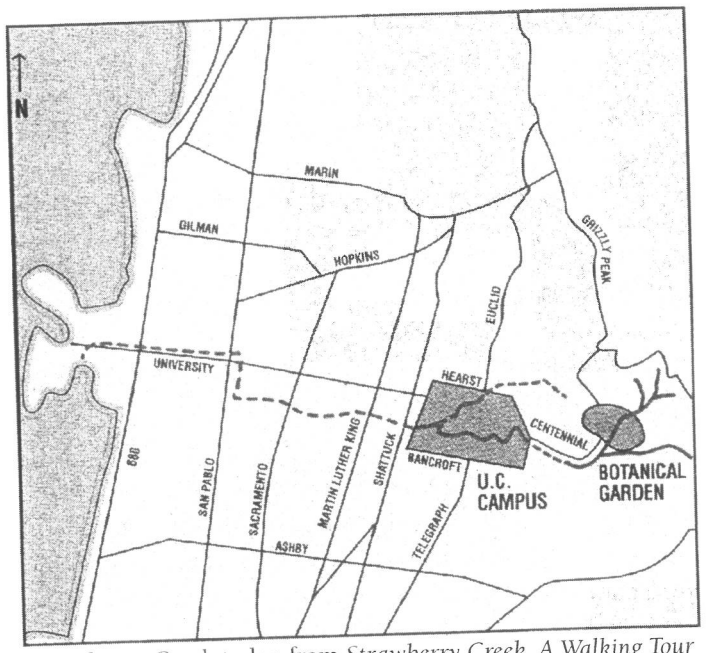


The creek, 1896.
University Archives (UARC PIC 200:45).

However, these efforts also proved futile, as erosion continued to worsen because

of higher storm flows caused by continuing development in the watershed. This situation led to a drastic engineering solution in 1907 as concrete "hardbed" was poured into the stream-bed and onto the banks, as reported in the *Daily Californian*:

> Work is steadily going on lining the bottom and sides of Strawberry Creek with concrete, in order to protect the trees on the banks. Already six of these concrete linings are completed, but work will continue until the rains. This cementing of the creek is being done all the way from the Gymnasium to the Agricultural College Farm [South Fork from around Sather Gate downstream to Oxford Street] wherever necessary to protect trees.[15]



Strawberry Creek today, from *Strawberry Creek, A Walking Tour of Campus Natural History,* ed. R. Charbonneau et al. (University of California at Berkeley, 1990).

Eventually many rock and concrete retaining walls were built along the stream banks to protect adjacent buildings, facilities, trees, and landscaping. The channelization and confinement of the creek became necessary as the campus grew and development encroached upon the meandering creek channels. Ironically, this channel constriction only increased the scouring effects of the storm flows, and exacerbated both erosion and flooding problems. The construction of Stephens Union in 1923 right on the banks of the South Fork actually required the stream course to be realigned towards the south in order to fit in the imposing building. In a pattern that would be continually repeated, the creek retaliated within two years as "heavy rains raised the water in Strawberry Creek to such an extent that a portion of the protecting wall was washed out at the east entrance to Stephens Union. The grading and winding of the stream was impaired."[16]

The first culvert was installed in the creek in 1883 on the west side of campus underneath Oxford Street to improve transportation in the city and possibly for public safety reasons:

> A culvert has been put in Strawberry Creek between Berkeley High School and the University grounds. Soon the street will be open for horses and wagons. This is a great convenience, as it much shortens the distance to be traveled by teams between the upper and lower parts of Berkeley, and in some cases does away with the necessity of wagons crossing the railroad track, which has in times past been a source of destruction of life and property.[17]

By 1897, the Oxford Street culvert had been extended to jog south underneath Allston Way to the west of Shattuck Avenue, where the creek then reappeared. Cement box culverts were installed along Strawberry Creek throughout its entire length westward during the

1880s, 1890s, and early 1900s. This continued through the 1930s when the Works Progress Administration (WPA) finished culverting most of the last open reaches. Nearly the entire length of Strawberry Creek down through Berkeley to the bay was eventually laid underground.

Straightening and realignment of the creek channel began in 1887, resulting in what should have been an early lesson in stream geomorphology, on the adverse effects of straightening meandering stream channels:

> One of the secretaries thought to change its meandering disposition by straightening out a loop or two in its devious course, but the wayward stream resented this by burrowing a narrow channel for itself some twenty feet deep where teams had been wont to cross but a few years before. In punishment for this, it was dammed at the lower part of the grounds, and it is now dutifully filling with sediment the canon that it eroded.[18]

Of course, instead of respecting the creek's natural tendencies, more engineering solutions were forced upon it. The "channel in back of the gym" (the South Fork downstream of Sather Gate) was straightened in 1904, and a few years later, in 1907, major channel alteration was done along the main branch upstream of the Oxford Street culvert. This reach was deepened in an attempt to increase its storm flow capacity in order to avoid flooding the downtown commercial district:

> In hope of coping with floodwaters through the campus during the winter rains, a force of men has been set at work deepening Strawberry Creek five feet, from Oxford St. eastward. The clogging of the mouth of the underground subway under Center St. last winter, threatening business property, has caused the deepening of the creek bed this summer in the hope that future trouble of this sort may be averted.[19]

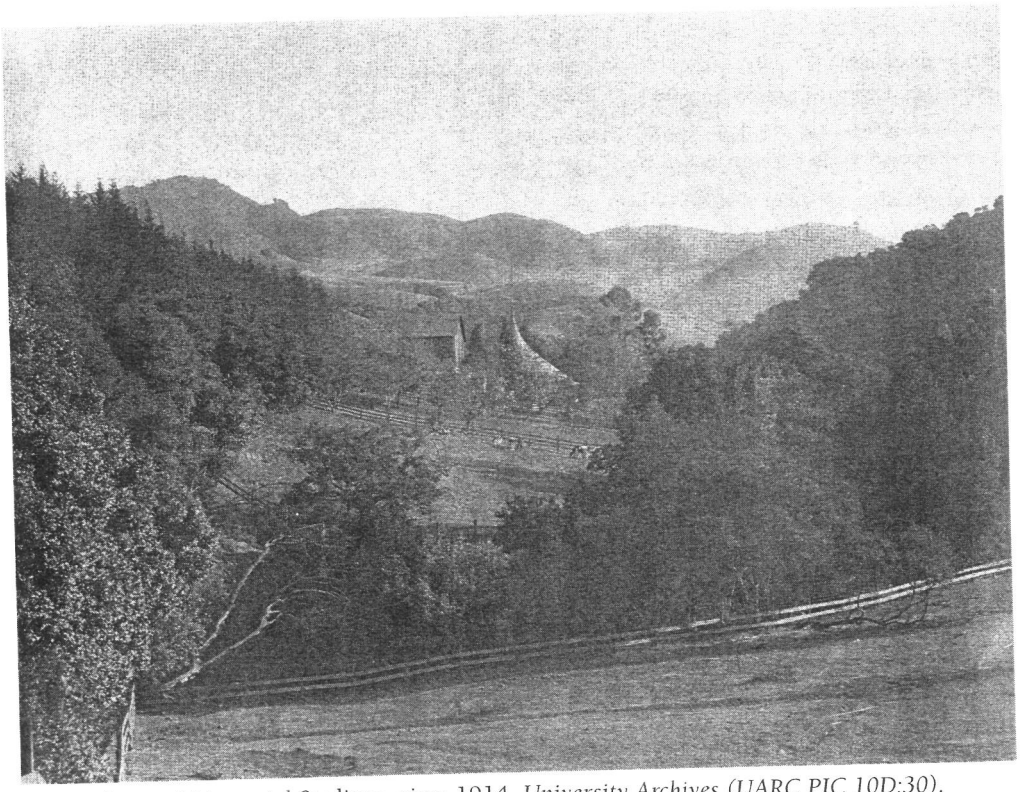
Interestingly, this culvert entrance still poses a similar problem: when high winter flows prevent campus grounds personnel from clearing the "grizzly" (metal trash rack set across the channel), it clogs with brush and debris, causing the streamflow to divert out of the channel and across the north bank, eroding it and threatening surrounding redwood trees. Campus architects and engineers continue to work on redesigning solutions to this problem.

Two major alterations to the creek occurred in the 1920s when culverts were installed for the construction of Memorial Stadium (1923) and West Circle (1928). Ironically, culverting of the north fork channel beneath the West Circle was a direct result of John Galen Howard's "Phoebe Apperson Hearst Architectural Plan" (1908) for the campus buildings and grounds. Howard, appointed both professor of architecture and campus architect, extensively modified Bénard's original grandiose Beaux Arts plan for the campus and aligned the "University axis" with the Golden Gate, connecting the Hearst Mining Circle with the West Circle, but also slicing across the North Fork at two points (the circle and just upstream at the footbridge below the Wickson Bridge).

In a glaring example of insensitivity towards the campus landscape, not much thought was given, or it was decided against, moving the West Circle east or west along the axis a hundred feet or so to avoid superimposing it upon the meandering North Fork. There did not appear to be any protest or controversy when the West Gate and Circle part of the plan was finally implemented. It was routinely reported in August 1928: "as part of the Phoebe Apperson Hearst plan of campus beautification, improvement will start when cement workers begin the construction of a culvert and a road across the North Fork of Strawberry Creek."[20]

So a significant reach of the North Fork was lost beneath the traffic circle, the only segment ever culverted on the central campus (besides the south fork entrance onto the eastern edge of campus).

A small meander in the South Fork was redirected around Stephens Union in 1923, and in 1934 several pools were created along the South Fork's "brand new rock-lined course . . . by building rubble retaining walls and channels. Some of these pools are three feet deep and twenty-five feet in length."[21] No other significant alteration of the creek on the central campus occurred until the 1960s, when major flood control storm drainage "improvements" were made. A concrete high-flow bypass structure was installed in the South Fork to cut off a tight meander behind the old art gallery building, and further downstream a 300-foot reach of the South Fork from Sather Gate to the Dwinelle Annex was widened to at least ten feet. In conjunction with this, a reinforced concrete retaining wall was also built along the south bank near the Golden Bear Student Center.[22]



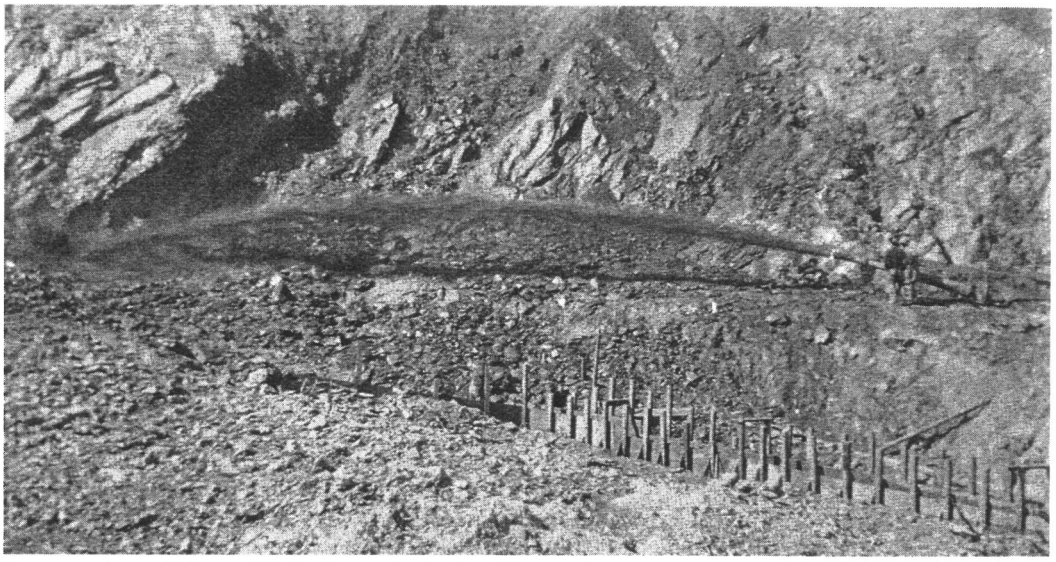
Original site of Memorial Stadium, circa 1914. *University Archives (UARC PIC 10D:30).*

The construction of the football stadium at the mouth of Strawberry Canyon in 1923 proved to be the most significant alteration of the South Fork. Several sites were considered for the stadium, but "the facts that the Canyon land is largely University property and that a structure could be erected there for a price within the amount subscribed to the Stadium fund were very prominent in the selection."[23] Other than objections from nearby Panoramic Hill residents, there did not appear to be any debate over the fate of the creek or orchard which were then located on the site. In fact, its severe environmental impact seemed only an afterthought. "When the California Memorial Stadium site was chosen it became evident that the waters of the stream had to be carried underneath the structure."[24] Despite this, the stadium had the enthusiastic support of the entire campus community and the alumni association.

Legal objections to the stadium were raised in April 1922 under the public trust doctrine. Ironically, it was argued that the university had condemned part of the lower canyon in 1876 for use as the campus water supply, and that it could not "devote the land to an entirely inconsistent purpose, such as the football stadium."[25] However, no lawsuit was ever filed, and work was scheduled to begin by the fall of 1922. The creek would be placed into a concrete box culvert beneath the stadium. The "Little Inch" culvert originally began just upstream of the stadium, at what is now Witter Field, and emptied out onto the central campus next to the Women's Faculty Club. Two small stream reaches remained open, between the present swimming pool, and the culvert's entrance, and in the vicinity of the parking lot above Kleeberger Field. But both of these short reaches were eventually put underground in the 1930s to allow additional campus development.

In another cruel twist of fate, the creek was harnessed as a water supply for hydraulic sluicing of the lower flanks of Charter Hill, later known as "Tightwad Hill," to make way for the stadium bowl. The creek was forced to become the agent of its own destruction:

> First concrete was poured in the construction of a large sewer which is to carry Strawberry Creek under the field. Two dams are to be built in the canyon to pond water used in the hydraulic process. Water will be pumped into an upper dam and forced against the hill on the east side of the creek to remove the earth. An estimated 280,000 yards of dirt will be removed from the hill. Water and dirt will be stopped at the lower end of the canyon and allowed to settle. The water will be pumped back into the upper dam and used again.[26]



Construction of Memorial Stadium, the hydraulic monitor.
University Archives (UARC PIC 10D:45e).

Hydraulic monitors (water cannons) used in placer mining were employed to blast the hill away and send it downstream into the creek and eventually the bay. The sluicing operations caused massive siltation, and surely had devastatingly lethal impacts on any living creatures that still inhabited the creek. The muddy eyesore created a general public outcry as evidenced by the following two letters to the editor of the *Daily Californian* in 1923:

> Why are we allowing our Strawberry Creek to be ruined? Here we have Strawberry Creek winding on its way across the campus, but we are letting it be turned into an ugly stream with the esthetic appeal of a river of cold coffee, with canned cream and the dregs and grounds of a few thousand coffee pots in it. We all want the Stadium, and want it quickly, but do we want it at the expense of our campus beauty? It will take a long time before our creek will be clear and sparkling again. When it does regain its clearness, it will be flowing over that deposit of red clay washed down from the hydraulic excavations for the Stadium. All the rocks will be buried in the sediment, and the creek will glide on, minus its beauty. Couldn't there be another outlet for the water and dirt from the Stadium excavation? Can't something be done before our creek is completely ruined?[27]

The second letter agrees:

> In my opinion, Strawberry Creek can no longer be numbered among the beauties of the campus. It is now only a trickle of dirty water in the bottom of a decidedly unpicturesque mud channel. About two weeks ago an article in The Californian mentioned the creek as "the most important factor in determining the location" of the University. Evidently, it was quite different in those days when the site for the campus was chosen because of it. In old volumes of the Blue and Gold I have seen pictures of Strawberry Creek and have read delightful descriptions beneath them. I am sorry to say that I see no resemblance between either the scenes or the descriptions and the creek as I have seen it during my first month on the campus. Of course I realize that the excavations at the Stadium are necessary, but I cannot admit the necessity of spoiling the beauty of the campus. There must be some way to avoid having the whole hillside washed into the creek. Why not install some filtering contrivance near the bridge at the end of College Avenue? Surely something should be done.[28]

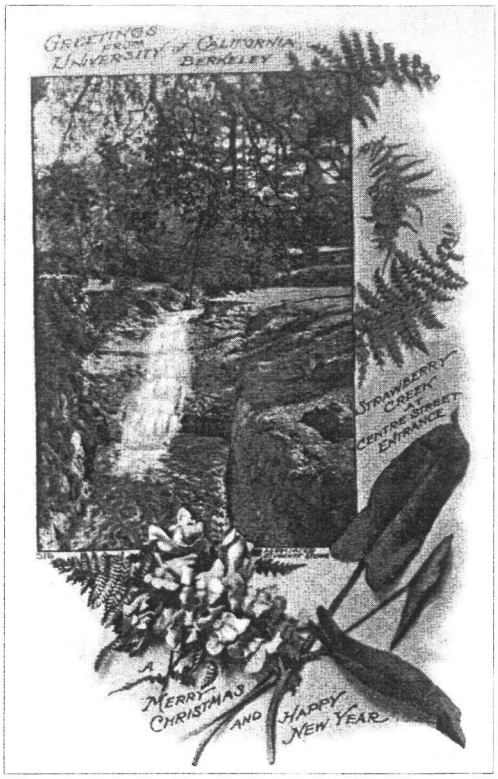
Thus the stadium construction had acute short-term effects on the South Fork, in addition to the critical permanent loss of the creek channel from the lower canyon downstream to the central campus. The stadium may also have been a turning point in the deterioration of overall relations between the university and the community. The urbanization of the campus and canyon watershed and resulting deleterious impacts on the creek are summed up well in this 1923 editorial in the *Daily Californian* entitled "Wheels of Progress."

> Once, in the days that are no more, there was a silver-watered brook that went its way unfettered from the Hills to the Bay. Its source was in the fingers of water that slipped down the tangled ravines into a winding canyon; its course was contentedly brisk in its upper reaches, peacefully unhurried below. Two or three modest bridges, rustic or of rough-finished timber, spanned it at intervals. Philosophers found in the stream food for quiet reflection, amorous couples the qualities of a discreet chaperone, and connoisseurs of leisure a valid excuse for doing nothing. Nor was it idle—it posed for artists and satisfied man's very real need for the companionship of running water.

> Now, in the days that are, there is a ditch of viscous liquid. The water no longer steals down ravines—it rushes down deep-furrowed gullies. Well up in the hills the burn had been blocked by a concrete swimming pool; when it emerges the brook that was finds but brief respite before it plunges into the grip of some three hundred yards of rigid, dungeon-like tunnel under a stadium. Then the creek must fight its way through a choking, inert conglomerate of yellow clay and detritus before it again subjects itself to the repression of a second tunnel, substituted for the plank bridge of old. Continuing, it squirms past one building after another, thrown out of its former bed here, allowed to remain all but throttled there. Repelled by the unyielding angularity of the Union, it dives under a cinder track, suffers the intrusion of gas pipes, water pipes, steam pipes, all specie of pipes, until, finally crushed by the ponderous majesty of Sather Gate and the crass vulgarity of Harmon gymnasium viewed from the rear, Strawberry Creek wearily wanders to the edge of campus, where it hopelessly resigns itself to the inevitable and is promptly snapped into the gaping maw of the Berkeley sewer.[29]

This bleak description stands in stark contrast to this romantic portrayal from twenty years earlier:

> North-Fork is a stream of perpetual shade—a veritable tangle of wild rose and blackberry, of laurel and creek willow, with here and there a sentinel oak. Brush aside a web of creepers, and your reward is a wealth of fern, scarlet columbine, and thimble-berry blossom. Where North Fork leaves the grounds is the spot where, one hot summer, Mexican Jose turnt the creek upside down in search of gold. There is gold along this creek, it is true, but it is the gold of beauty. . . . Strawberry Canyon is the most frequented tramp in Berkeley, perhaps because one may stroll along the upper creek bed and lose sight of all that reminds him of a town—forget, for a little while, streets, and houses, and gardens . . . and books. Running between the walls of the hill, over a tumbled bed of boulders, and through regular tunnels of oak and laurel and willow, and tangled disorder of creeper and fern, Strawberry Creek has an untamed beauty and waywardness that pleases as no garden or park-land can.[30]



The creek near Center Street, Postcard, circa 1900. *University Archives (UARC PIC 2:144a).*

Eventually, the creek fought back. As the Strawberry Canyon watershed urbanized, the resulting higher-peak winter storm flows caused not only erosion problems, but also

posed a greater risk of flooding to campus buildings and the commercial districts both north and west of campus. Increasingly complex and expensive engineering alterations were made to the creek and the associated storm drain system in attempts to alleviate the flooding problem, first noted in 1904:

> The creek was roaring full along its entire length and the force of the water did much damage to the banks. Many drifting logs were carried down to Oxford Street, where the creek flows into an underground culvert, and did much damage. The North Branch overflowed its banks, the water coming down Euclid Avenue in a torrent swept across the street and down into the channel of the creek.[31]

City officials blamed university grounds personnel for placing logs and other materials in the creek channel as riprap to armor the banks, subsequently these were washed downstream and blocking the culvert inlet, and causing flooding and erosion damage.[32] This directly led to the deepening of the main branch channel upstream of the Oxford Street culvert in 1907.

The culverting of the South Fork beneath the stadium in 1923 resulted in much faster conveyance of storm water onto the campus. The flows now ran through a smooth straight concrete culvert, instead of winding down a rough naturally meandering channel. The following is an account of a winter storm in 1925:

> The soil of our campus took leave of us through Strawberry Creek—or rather what used to be Strawberry Creek. Twas only Thursday that the "deluge" tore away the rocks from one side of the creek and turned it into a huge river. . . . Pessimistic students were predicting the transfer of our Alma Mater to Mount Tamalpais for protection against old Dame Nature. Imaginative frosh hoped heartily for a second Noah's Ark. Said one, "No more shall it be called Strawberry Creek, even though that does sound luscious and lovely—our creek has graduated and may now be called 'U.C. River.'" And then, the "fixers" arrived and waded around in their big rubber boots, replacing huge rocks until our big river became just Strawberry Creek again.[33]

Flooding problems would only worsen in the future. A 1940 winter storm flooded the Northside district due to an obstructed culvert. The same storm caused extensive damage and landslides in Strawberry Canyon, and flooded both Gilman Hall and Stephens Union, ultimately causing $50,000 in damages to campus facilities, mainly in the canyon. The university responded in the usual fashion in the fall of 1940 by building culverts, "grizzly" trash racks, check dams, and "all necessary reinforcements" in the lower canyon area.[34]

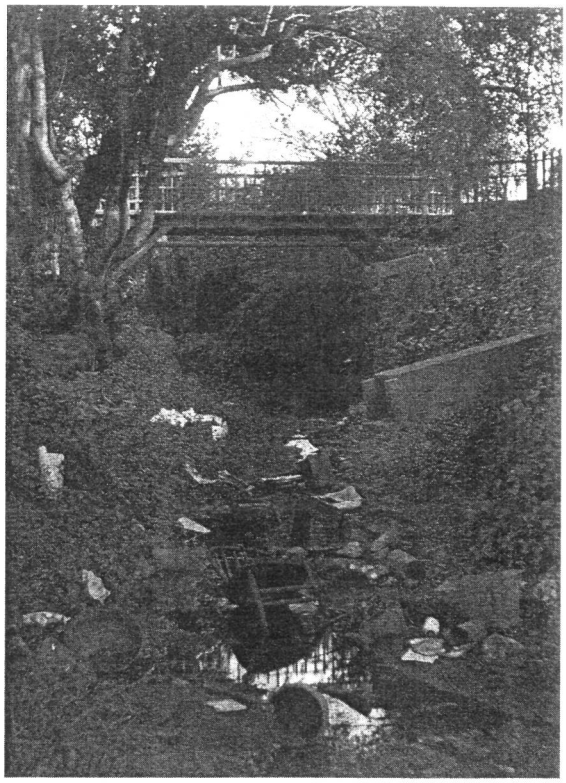
In 1951, a larger "Big Inch" creek bypass culvert was built starting in the canyon just above the Strawberry Canyon pools, following Rimway around the stadium, and emptying out next to the Faculty Club on campus. The "Big Inch" was built at a cost of $225,000 due to the possibility of structural failure of the original "Little Inch" culvert. Cracks were discovered in the old culvert caused by displacement along the Hayward fault zone.[35] The failure of the culvert under the stadium would later combine with the failure of an adjacent sanitary sewer line to cause serious sewage contamination of the creek during football games.

From the 1940s through the 1960s, the Radiation Laboratory (now Lawrence Berkeley National Laboratory, LBNL) was extensively developed on the steep hills north of Straw-

berry Canyon. The upper reaches of the North Fork and numerous seasonal tributaries were culverted and incorporated into the laboratory's storm drain system. Radiation Lab buildings and roadways created large volumes of storm water runoff which was conveyed rapidly downhill into both the North and South Forks, resulting in significantly larger peak flows and higher flood stages downstream. The lag time (interval between peak precipitation and peak runoff in the creek) was reduced from about two hours for rainwater to run off the hills, down to just fifteen minutes. Storms that were easily handled by the creek in the past now posed a potential threat of severe erosion and flooding.

It did not take long for these threats to become reality. In April 1958, rains caused $70,000 of damage to canyon roads and storm drain systems: International House was flooded and landslides blocked parts of the Radiation Lab and fire trails in the canyon. Only four years later in October 1962, fifteen inches of rain fell over four days, one of the heaviest storms ever recorded in the San Francisco Bay area. The "Big Inch" bypass culvert was clogged with debris, causing the torrential South Fork to flow into the Strawberry Canyon pool complex, down Centennial Drive and right through Cowell Hospital and International House. Mudflows closed roads and filled the pools. Damage to campus buildings and grounds was estimated at over $200,000. In 1964, the university spent $519,000 on extensive storm drain and creek "improvements" to alleviate flooding problems.[36]

In 1966, the university extended the "Big Inch" bypass culvert further upstream to an earthen retention dam built in Strawberry Canyon, at the entrance to the lower fire trail, across from the poultry area. The "Big Inch" culvert now travels 4,300 feet to its outlet at the Faculty Club. The dam and retention basin would store flood waters during winter storms and regulate flow into the culvert by means of a hydraulically operated gate, thereby preventing recurrence of the extensive flooding damage that occurred in 1962. Also, in 1966, a high flow bypass was built into the city's storm drain system on the North Fork to relieve the flooding threat caused by increased runoff from Lawrence Radiation Laboratory in the hills above Northside. These storm drain improvements were done at a cost of $145,000 shared by the city and university.[37]



Strawberry Creek, date unknown. *University Archives (UARC PIC 2:113).*

The culverting, re-engineering of the upper reaches of the creek into an artificial storm drain and flood control system, and numerous channel alterations of the open lower reaches were all completed in 1966. Not coincidentally, urbanization of the creek's watershed was also essentially complete, although there would be continuing incremental development in the canyon over the next thirty years.

The rise of the environmental movement and ecological awareness in the late 1960s and 1970s did not seem to translate into any campus action or improvement in the creek's condition. Perhaps the turbulent

campus protests of that era preoccupied both students and faculty alike. With a decidedly resigned tone the general ills of urbanization are outlined in a 1973 article in the *Daily Californian*, "Strawberry Creek's Troubled Waters":

> For years Strawberry Creek has given campus passersby refreshing moments of tranquillity, but recently its natural beauty has been compromised by the demands of an urban environment. . . . Though Strawberry still has the serenity of long ago, it has undergone a sort of identity crisis. The cement banks and dams, the impure water and the excessive number of people are common complaints. . . . Though once a natural creek bed, Strawberry Creek is now part of an urban area. Planning needs have forced control of its path and flow. . . . Numerous storm sewers also empty into the stream, contributing dirty wash waters to the creek. . . . The natural absorbency and filtrating action of the soil on campus is prevented because of the acres of asphalt surrounding the stream. . . . Years ago, days of heavy rain would have been necessary to flood the creek. Today a few hours of moderately heavy rainfall can transform the placid creek into a turbulent storm sewer. . . . The winter flooding which intensifies bank decay causes further concern. . . . More stable materials, like cement, must often be used because the dirt will not hold. Another problem—one that most people have come to expect by now—is that of pollution.[38]

In 1981, city health department officials warned that the creek was polluted by sewage, urban runoff, and chemicals dumped into storm drains:

> Strawberry Creek is badly contaminated. . . . The creek may, at any moment, be filled with sewage or chemicals. . . . "Strawberry Creek is readily accessible–anything can go in it." . . . The stream is contaminated by dogs, the wash from streets and cars, and citizens who empty chemicals and sewage into the creek. . . . coliform bacteria has been found in the creek, indicative of sewage pollution. . . . The creek's contamination is the result of the attitude of people who use the stream. . . . It's treated as a sewer by people. [Campus Environmental Health and Safety] conducted a study of the contamination of Strawberry Creek several years ago and made an effort to clean up the creek. . . . In the past, EH&S has sampled the creek every couple of months in response to specific requests, but has never seemed to find the source of spills. . . . EH&S has no regular creek sampling planned. . . .advice to those who live, work, and study around the creek: "Look at it. Don't go in it."[39]

So Strawberry Creek lapsed into a steady state of benign neglect, until various forces serendipitously came together in 1987 to begin the restoration and revival of Berkeley's beloved and storied creek.

ENDNOTES

1 Personal communication from Professor Kent Lightfoot, Department of Anthropology, July 1999.

2 *Berkeleyan*, December 8, 1885, 64.

3 Samuel Hopkins Willey, *History of the College of California* (San Francisco: Samuel Carson & Co., 1887), 36-37.

4 Ibid., 106-107.

5 Ibid., 172.

6 Ibid., 199-200.

7 *Berkeleyan*, January 20, 1896, 1.

8 *Daily Californian*, June 28, 1906, 1.

9 *Berkeleyan*, September 29, 1877, 7.

10 *Berkeleyan*, September 23, 1895, 2.

11 *Berkeleyan*, February 1882, 12.

12 *Berkeleyan,* October 23, 1882, 13.

13 *Berkeleyan*, November 6, 1882, 12.

14 *Daily Californian*, October 11, 1904, 1.

15 *Daily Californian*, October 18, 1907, 2.

16 *Daily Californian*, February 13, 1925, 1.

17 *Berkeleyan*, April 23, 1883, 12.

18 *1887 Blue and Gold*, 13 (1886), 210.

19 *Daily Californian*, September 17, 1907, 3.

20 *Daily Californian*, August 27, 1928, 2.

21 *Daily Californian*, January 30, 1934, 2.

22 *Daily Californian*, February 28, 1964, 11.

23 *Daily Californian*, February 23, 1922, 1.

24 *Daily Californian*, August 31, 1923, 8.

25 *Daily Californian*, April 12, 1922, 1.

26 *Daily Californian*, January 15, 1923, 1.

27 *Daily Californian*, April 3, 1923, 2.

28 *Daily Californian*, October 4, 1923, 8.

29 *Daily Californian*, November 8, 1923, 6.

30 *1903 Blue & Gold*, 29 (1902), 3-4.

31 *Daily Californian*, March 11, 1904, 1.

32 *Daily Californian*, March 15, 1904, 1.

33 *Daily Californian*, February 16, 1925, 6.

34 *Daily Californian*, November 1, 1940, 4.

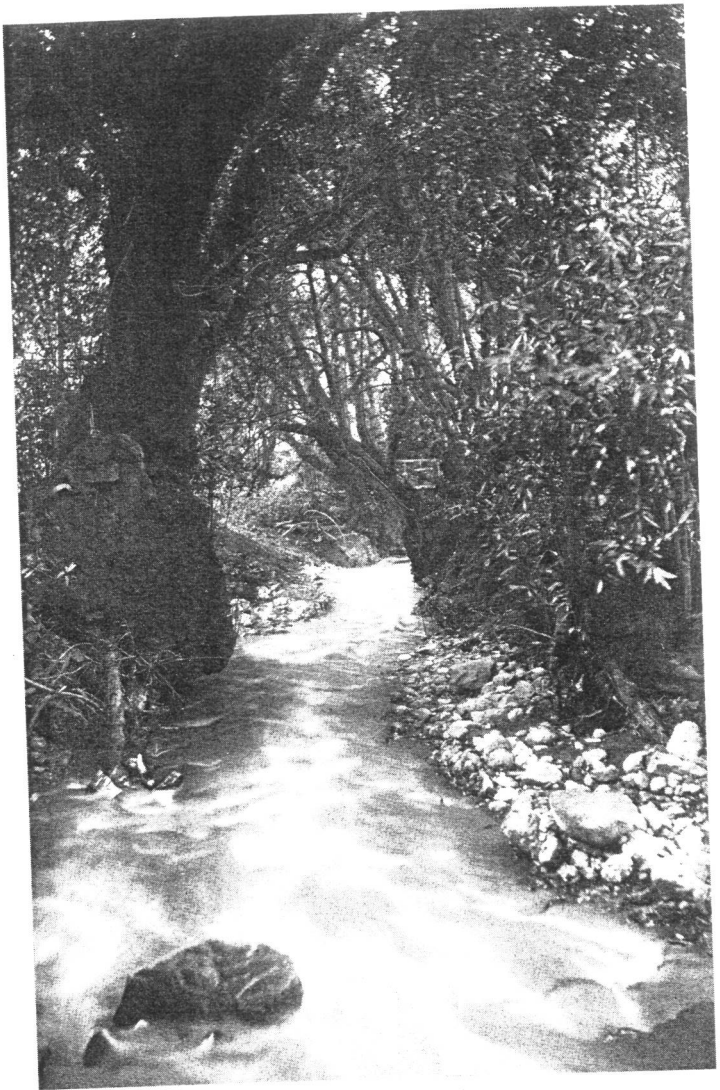
35 *Daily Californian*, March 1, 1951, 10.

36 *Daily Californian*, November 2, 1964, 10.

37 *Daily Californian*, October 31, 1966, 9.

38 *Daily Californian*, July 2, 1973, 6.

39 *Daily Californian*, November 2, 1981, 1.



Co-ed Canyon (Faculty Glade), 1904.
University Archives (UARC PIC 200:25).

STRAWBERRY CREEK II

RESTORING THE CREEK, 1987–1989
A PERSONAL PERSPECTIVE

Robert Charbonneau

This is a personal account of the urban stream restoration project on Strawberry Creek that I coordinated in the late 1980s. It summarizes the major activities and the key people responsible for the project's ultimate success, highlighted by the reintroduction of native fisheries in the creek following a century's absence. For a more technical discussion of the project, please refer to the scientific journal article on the subject.[1]

BY THE 1980S, STRAWBERRY CREEK HAD BECOME a typically neglected urban stream. Its troubled waters were polluted with street runoff, chemicals, and raw sewage. Many aquatic organisms and native plants had nearly disappeared from the creek and along its riparian corridor. Recurrent winter flood waters undercut stream banks; cement banks and dams, built to fight erosion, detracted from the creek's natural beauty. As the creek's ecological and aesthetic qualities continued to deteriorate slowly, the campus displayed a dismaying lack of knowledge or concern.

In May 1985, a concerned group of faculty representing the natural and environmental sciences complained in a memo to Professor Calvin Moore about the degraded condition of the creek. They stated that the creek was polluted, partly by campus discharges, and called for a comprehensive study of the entire watershed to identify all sources of pollution. The group offered the research assistance of students and faculty, and noted that "if we ignore the pollution in Strawberry Creek, the University may find itself in an embarrassing and costly situation. A great University should not have running sores on its land."[2]

Professor Moore recommended to the Campus Planning Office that an advisory committee be formed to deal with creek environmental quality issues. In September 1985, the Environmental Health and Safety Office (EH&S) followed up on the faculty memo, concluding that dogs were responsible for the high fecal bacteria counts in the creek, and that trace heavy metals were originating from street runoff. EH&S reviewed its own files and reported that a comprehensive sanitary survey to locate and reroute sewer lines draining from campus buildings into the creek was successfully completed in the early 1970s, leaving only storm drains to empty into the creek.[3] The administration's conclusion that unleashed dogs were responsible for bacterial contamination of the creek outraged even the most conservative natural sciences faculty and galvanized their support for the restoration of Strawberry Creek.

In fall 1985, EH&S committed to "examining some long-range solutions" to the polluted creek because of the potential "significant health hazard."[4] In March 1986 Luna Leopold, chair of the geology department, complained of the creek's condition to the campus Hazardous Waste Management Committee, stating that "in the last decade, all studies with which I am familiar have shown that the stream is polluted to the point that no insect life grows on the bed of the channel." Leopold recommended that EH&S perform water quality sampling and sanitary engineering investigations to identify specific point-sources of pollution on campus.[5] Finally, in

June 1986 the EH&S associate director reviewed Strawberry Creek files and recommended the development of a master plan and various sanitary engineering remedies.[6]

Around the same time, I packed my bags in Massachusetts and headed for Berkeley to work towards my master's degree in environmental planning in the College of Environmental Design. I had received my B.S. degree in environmental sciences with a concentration in water pollution biology from the University of Massachusetts at Amherst and since 1980 had gained valuable experience working on dozens of stream and lake water quality studies and projects.

Restoration Project Inception

Near the end of the fall 1986 semester, I went to the campus EH&S office to try to find gainful employment, because I had previously worked for EH&S at the University of Massachusetts. As my savings dwindled, I was motivated to accept the only student work-study position available in the industrial hygiene program. Over the next several months, I visited every campus laboratory and in the process got to know the campus buildings and grounds in excruciating detail.

Early in the spring 1987 semester, I spoke with EH&S Associate Director Ben Gonzales about potential topics for my master's professional report (an applied version of a thesis). Ben told me about several hazardous-materials-related options but mentioned as an afterthought, "Then there's always Strawberry Creek." So inadvertently I began a project that would consume much of my life over the next two and one-half years.

In March 1987, EH&S management applied for a $15,000 Business and Administrative Services (BAS) opportunity grant to work on Strawberry Creek. Ben Gonzales and Director Elaine Bild's unwavering administrative and political support would be essential throughout the project. Dan Boggan, the administrative vice chancellor, soon approved the BAS grant, although I had already commenced initial research on the project.

During the spring of 1987, I met several staff and faculty who would prove instrumental in the future success of the restoration project. No one would be more essential or supportive than Sonja Biorn-Hansen, the facilities department engineer who oversaw all underground utilities systems and associated deferred maintenance projects. Sonja would become a trusted colleague and formidable ally over the next few years. I also soon met Vince Resh, an enthusiastic entomology professor with a passion for the creek, who became my closest academic advisor and strongest faculty supporter.

Sanitary Engineering and Water Quality Studies, Spring 1987

I spent most of spring 1987 reviewing and compiling existing information and gaining an understanding of the creek and its canyon watershed area. The storm drain system map was quite outdated; because many parts of the campus utility infrastructure were over fifty years old, anything was possible in terms of how drainpipes had been connected and what eventually emptied into the creek. Over one hundred drainpipes were located on the banks of Strawberry Creek on the central campus. It would take over a year to determine where all these pipes originated. Both the storm drain and sanitary sewer system maps had to be completely updated and revised. Sometimes this would require crawling through large culverts with a flashlight and map, armed with a baseball bat to ward off unhappy rodents.

After much time-consuming and laborious sanitary engineering work, Sonja and I determined that there were multiple problems with both the storm and sanitary sewer systems due to their age and condition. Acting on a faculty complaint about sewage contamination from the stadium, we dye-tested the bathrooms and sampled the South Fork of Strawberry Creek before, during, and after football games. We found massive bacterial contamination in the creek during

half time and immediately after games, as stadium toilets were flushed thousands of times. A broken sewer line beneath the stadium was flowing into an adjacent broken storm drain line, sending raw sewage spewing out into the creek. Sonja soon undertook an extensive sewer system rehabilitation project to fix the stadium infrastructure damaged by movement along the Hayward fault zone.

We discovered several other sewer leaks, none more puzzling than one contaminating a storm drain coming from Harmon Gymnasium. We dye-tested all of the drains and bathrooms in the gym but uncovered no problems. Following the storm drain line up from the gym, we traced the source to the Bear's Lair pub bathrooms, which had been retrofitted into the student union building several years earlier. The plumber had incorrectly tied the pipes into a storm drain line coming down from the roof drains, instead of into the adjacent sanitary sewer line, allowing raw sewage to drain directly to the creek. This certainly validated Murphy's Law and reinforced the need to be thorough and vigilant in our investigations.

Evaluating the campus sewer system for breaks and cross-connections sometimes resulted in surreal experiences. We often used fluorescein, a non-toxic fluorescent green dye, for tracer and flow tests. On more than one occasion, the creek turned day-glo green as a result of our dye tests. One day, a facilities worker inadvertently added too much dye to a sewer manhole, not only turning the creek fluorescent green, but a significant portion of the bay as well. The coast guard was alerted and responded, but by then the plume had spread out over such a wide area that they were unable to find its source.

During the summer of 1987, I conducted comprehensive ambient water quality sampling of both the north and south forks, covering the headwaters in Strawberry and Blackberry Canyons as well as the upper and lower ends of the creek on the central campus. Ben Tamplin, director of the state's sanitation lab in Berkeley and a Cal alumnus, agreed to analyze all of the creek samples for a wide range of water quality parameters on a pro bono basis, saving a significant amount of money as well as assuring quality control on the analytical results. These cost savings allowed us to contract with a commercial environmental laboratory to sample and analyze all campus point-source discharges (effluent from continuously flowing drainpipes).

These ongoing sanitary engineering and water quality investigations continued to uncover problems. Over the next two years, various sewer leaks were repaired and discharges rerouted to the sanitary sewer. Today, the campus facilities department continues to fix sewer leaks as soon as they are discovered, and diverts minor drains to the sanitary sewer system whenever possible. We also worked with the facilities department to improve street sweeping and catch basin cleaning in an attempt to mitigate urban storm-runoff pollution. The water quality of the creek improved dramatically. Macroinvertebrate (aquatic insect) surveys, a widely used biological indicator of environmental quality, showed the creek improved from "poor" to "good" condition.

The Creek Committee

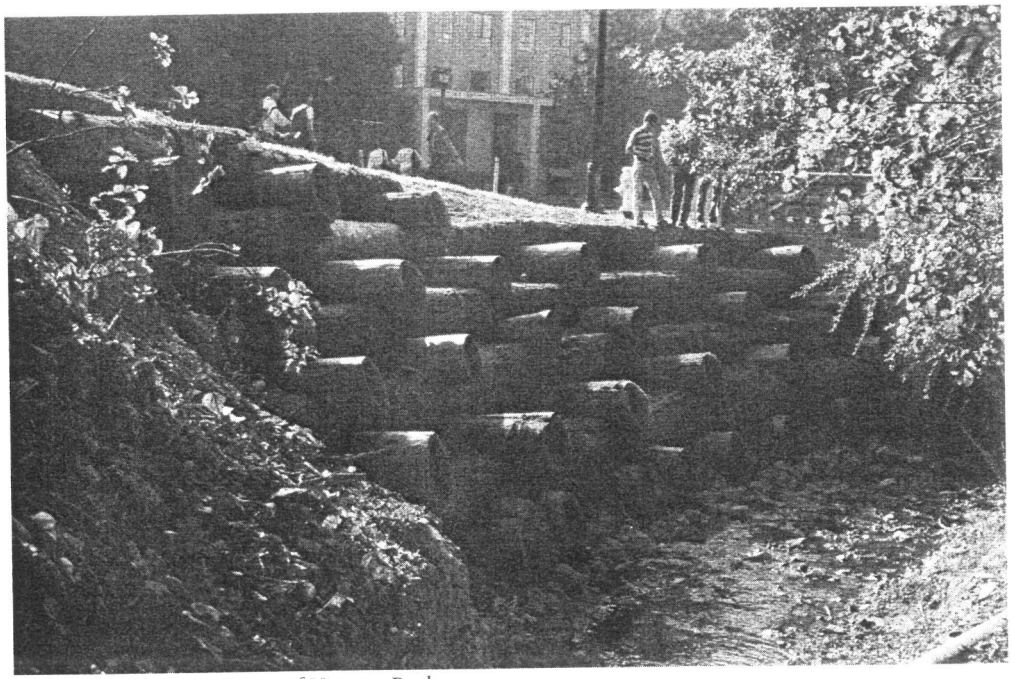
In October 1987, Sonja Biorn-Hansen and I made a presentation to Vice Chancellor Boggan and his BAS directors, discussing the results of the initial creek study and recommendations for restoration, with an emphasis on the value of the creek to the campus. Boggan enthusiastically received the presentation and committed his support for restoration of the creek. In November 1987, the vice chancellor officially established the Strawberry Creek Environmental Quality Committee, a chancellor's advisory group composed of faculty, staff, and students.

Joe McBride, chair of the Department of Forestry and a respected campus environmental advocate, was the first committee chair. Other faculty originally included Vince Resh (entomology) and Bob Twiss (landscape architecture). Campus staff included Sonja, EH&S personnel, the campus landscape architect, and me as the student representative. Soon after, the campus grounds

manager, a campus environmental planner, and a botanical garden staff member were added. Eventually, liaison representatives from the city of Berkeley (director of Parks and Recreation) and the Lawrence Berkeley Laboratory (EH&S director) joined the committee because both the city and the laboratory controlled portions of the upper watershed, mainly along the North Fork.

This committee proved invaluable in cutting through the red tape associated with these three bureaucracies and allowed work to proceed relatively unhindered by political obstacles and squabbles. Sonja served a pivotal project management role while providing engineering expertise and access to deferred maintenance funding. The committee agreed upon an ambitious set of goals: enhance the teaching and research value of the creek; restore ecological integrity of the creek to the greatest extent possible; provide innovative examples of urban creek restoration techniques through demonstration projects; and preserve and enhance the creek as both a campus and city amenity.

By fall 1987, I had essentially completed the initial water quality study. However, in order to formulate a truly comprehensive creek management plan, the scope expanded into broader areas of watershed management, urban stream restoration, and environmental education. I finished the first draft of the Strawberry Creek Management Plan by January 1988. After graduating in the fall of 1988, I became a full-time EH&S staff member, responsible for implementing my plan.



Cribwall, 1988. *Courtesy of Vincent Resh.*

Erosion Control

In 1988, restoration activities began and continued in earnest for almost two years. Many stream banks and structures along the creek were near collapse from lack of maintenance and relentless erosion. Sedimentation threatened the health of the creek's biota and habitat. In the spring of 1988, Philip Williams and Associates, a local hydrology firm, analyzed erosion and bank stabilization options, prioritizing and recommending sites along the creek for repair and stabilization of stream banks, check dams, retaining walls, and utility overcrossings. Over the next

year, we used a combination of private contractors and the California Conservation Corps to do erosion control work on campus and in Strawberry Canyon.

Plantings in cribwall. *Courtesy of Vincent Resh.*

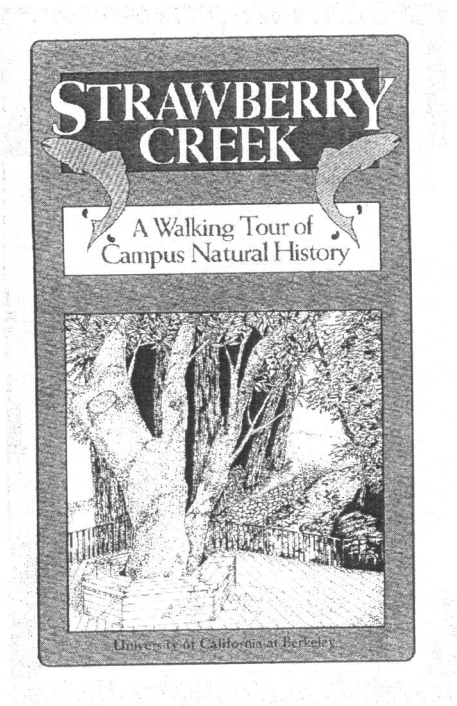
During the summer of 1988, we worked on a major project opposite Stephens Hall, where the creek was eroding a high vertical creek bank, collapsing the lawn and undercutting the bridge supports. Instead of installing a conventional concrete retaining wall, we decided to try a biotechnical approach—a redwood cribwall. The cribwall combined native vegetation and redwood logs, forming an integrated structure more durable, cost-effective, and environmentally compatible than a concrete wall.

The designing engineer specified redwood logs at least twelve inches in diameter. We specified this minimum size in our bid specifications to Bay Area lumber companies, envisioning telephone-pole size logs. When the over-sized big rig from the Santa Cruz mountains rumbled onto campus with our load of logs, we were shocked. The logs were a foot thick at the top and some were nearly three feet at the base! Luckily, our contractor was able to conceal the large ends by burying them about 15 feet into the bank as tieback logs. The cribwall was backfilled with soil to provide strength, weight, and a place for plants to grow. Later planted with a wide variety of native vegetation by faculty and student volunteers, today the cribwall appears quite natural and aesthetically pleasing. Due to extensive plant roots, this bank will remain stable after the cribwall logs rot out.

Further downstream, adjacent to the 1935 Student Glade just east of Sather Gate, we modified the inlet to a high-flow bypass structure, restoring a natural stream channel meander that had been cut off and left dry since the bypass was constructed in the 1960s.

Environmental Education

Environmental education was a major focus of the restoration project; raising awareness of the creek and changing campus attitudes would be crucial to our long-term success. Our target audiences included students, staff, Northside residents, and the general public. I gave many guest lectures on the creek to classes in landscape architecture, biology, planning, forestry, environmental

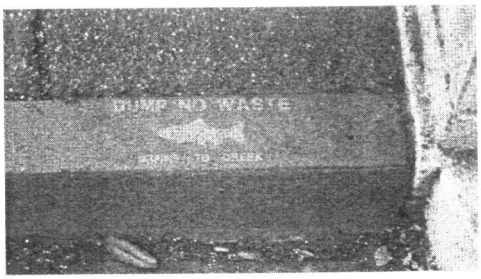


1990 booklet.

science, and conservation resource studies. I also gave presentations at professional meetings and conferences and to campus administrative departments. Vince and I led numerous walking tours of the creek and canyon watershed for classes, conferences, and docent and staff groups. We also created the booklet "Strawberry Creek—A Walking Tour of Campus Natural History," which was extremely popular with over 10,000 copies distributed. We are currently completely revising it, and EH&S hopes to print 10,000 copies of the second edition this spring.

In 1989, we embarked on two major public education campaigns. The first was an idea we borrowed from an urban stream restoration group in Seattle. We designed a curb stencil that read "Dump No Waste—Drains to Creek" around a playful fish logo. To the best of my knowledge, we were the first in the Bay Area to spray-paint these stencils on curbs next to gutter storm drains and eventually on all campus drains. We also got permission from city public works to paint these stencils on storm drains in the Northside district. Similar curb stencils can now be seen in cities all over the country. In 1988, Sonja and I participated in the founding of a grassroots citizens group (Berkeley Citizens for Creek Restoration) that would later stencil drains located above each culverted creek in Berkeley with its own distinctive ecological symbol and the name of the creek.

The second major public education effort was a mass informational mailing to all Northside residents and businesses located within Strawberry Creek's North Fork watershed area. As part of this cooperative effort with the city, a cover letter was jointly signed by Vice Chancellor Boggan and the city manager informing people how to be environmentally friendly watershed residents. This may be one of the few times that both high-ranking university and city officials jointly endorsed a public letter.



Courtesy of Vincent Resh.

In March 1989, the committee collaborated with the city and Berkeley Citizens for Creek Restoration to sponsor Spring Creek Week, a weeklong series of events held around the campus and city. Activities included planting native vegetation along the creek, lectures, receptions, dance performances in Faculty Glade, walking tours, and environmental art installations around campus. The week ended with storytelling, a dance performance, and a community potluck at Strawberry Creek Park in West Berkeley, where the creek had been daylighted out of its culvert in the mid-1980s as the urban park's centerpiece.

Later in 1989, we assisted the university's Botanical Garden with the funding, design and layout of a creekside trail, a watershed overlook deck, and interpretive displays in the lower part of the garden. The garden later celebrated the completion of these projects with a Creek and Watershed symposium in 1990. The garden became the focal point for environmental education about the creek headwaters and its upper canyon watershed.

The author leading a creek walk. *Photograph by Allen Stross.*

Restoration of the Native Fish

Our restoration efforts culminated in May 1989, when we reintroduced native fish into the creek for the first time in over a century. Fisheries likely disappeared from the creek after the University of California relocated to Berkeley in 1873, diverted the creek in Strawberry Canyon for its water supply, and dumped raw sewage until the turn of the century when sewers were built. Obstacles such as check dams and culverts were installed beginning in the 1870s. These actions resulted in very low stream flows, poor water quality, habitat destruction, and barriers to fish migration, which all led to the disappearance of fish in the creek.

The initial 1987 creek study used bioassays with two sensitive aquatic organisms (fathead minnows and a crustacean) to study the feasibility of restocking fish. When these clinical observations indicated it was theoretically possible, restoring native fisheries became a priority and an important symbolic goal of the project.

Campus ichthyologists helped me to identify likely native fish species and their nearest present-day sources. The creek committee initially nominated trout, but then dismissed them as non-native and potentially risky in terms of suitable habitat and water quality conditions. We eventually decided to stock with three-spined sticklebacks, a small native, hardy fish able to live in disturbed habitats. As a bonus, the sticklebacks were interesting to study and observe from a teaching standpoint, and their prominent dorsal spikes made them such an attractive icon that the fish's image eventually found its way onto the cover of student orientation booklets and T-shirts.

With the cooperation of East Bay Regional Parks District biologists, we collected sticklebacks from Wildcat Creek, and released about a hundred into Strawberry Creek with accompanying publicity including local television and radio coverage. We were anxious for a few days, but the fish did well, and no mortality was observed. Interestingly, the sticklebacks have since been displaced by two species of native minnows (California roach and hitch) stocked later, which proved to be better adapted to living in the creek. The sticklebacks, flushed downstream during winter storms, are now abundant around the Berkeley Marina near where the creek enters the

San Francisco Bay. The minnows are still doing well and continue to spawn each summer. Early in 1991, snowy egrets were observed foraging for fish in the creek for the first time in memory. We are hopeful that over time other native animals will return to the creek and its recently bolstered ecosystem.

Parting Thoughts

An incredible amount of progress was made for Strawberry Creek in a relatively short time, more amazing given the bureaucratic nature of such a large institution as the university. This rapid progress was mainly due to the hard work and dedication of the many people directly involved in the project but would not have been possible without the political support that allowed us to do the work.

Strawberry Creek reflects the urban conditions of its watershed. Unfortunately, we are bound by the constraints that over a century of development has forced upon both the creek and us. The creek will always serve as the storm drain system for the watershed, and human carelessness and accidents will inevitably result in sporadic spills and releases into the creek. Extensive development in the watershed has permanently altered the creek's hydrology, creating "flashy" flow conditions. Channel alterations and obstacles, such as check dams, limit the creek's available habitat and create barriers to fish migration. Moreover, the environmental quality of this urban creek cannot be sustained without constant vigilance and regular maintenance.

Periodic re-education of campus staff and contractors is needed to maintain awareness about the creek and activities that can adversely impact it. However, we achieved the goals set forth at the start of the restoration, and the project is widely considered a success. The creek is certainly much healthier than it was. Our greatest accomplishment may be that attitudes towards the creek have changed, and awareness has been heightened. Now, when spills occur in the creek, campus officials receive multiple reports, in contrast to fifteen years ago when no one would have even noticed. I sincerely hope that many years from now I can revisit the creek and admire the descendants of the native fish we have reintroduced.

ENDNOTES

1 Robert Charbonneau and Vincent Resh, "Strawberry Creek on the University of California, Berkeley, campus: A case history of urban stream restoration," *Aquatic Conservation: Marine and Freshwater Ecosystems* 2 (1992), 293-307.

2 H.V. Daly, College of Natural Resources, memo to Calvin Moore, "Some preliminary information and thoughts on pollution in Strawberry Creek," May 2, 1985.

3 "Strawberry Creek Water Quality Issues," EH&S internal memo, September 12, 1985.

4 Don Erman, Associate Dean of College of Natural Resources, memo to EH&S Director, October 15, 1985.

5 Chairman Luna Leopold, Department of Geology and Geophysics, memo to EH&S Hazardous Waste Management Committee, March 19, 1986.

6 Ben Gonzales, EH&S Associate Director, memo to James Brown, Director, "Environmental Quality of Strawberry Creek," June 10, 1986.

THE CAMPUS CONSERVATORY

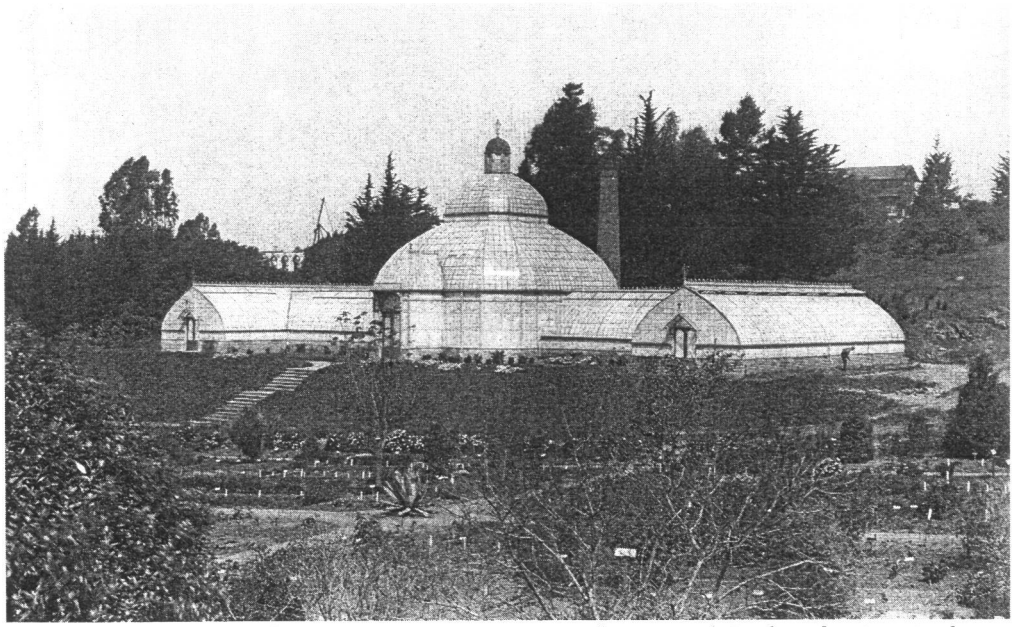
William Roberts

THE BEGINNINGS OF THE BOTANICAL GARDEN go back to the 1870s, with the appointment of Eugene W. Hilgard as professor of agriculture and agricultural chemistry. Hilgard called for the "continuation and expansion of the experimental cultures on the grounds assigned to the department on the university campus, and the establishment of a garden of economically important plants, both for experiment and for the instruction of classes by actual demonstration and exhibition of the growing plants."

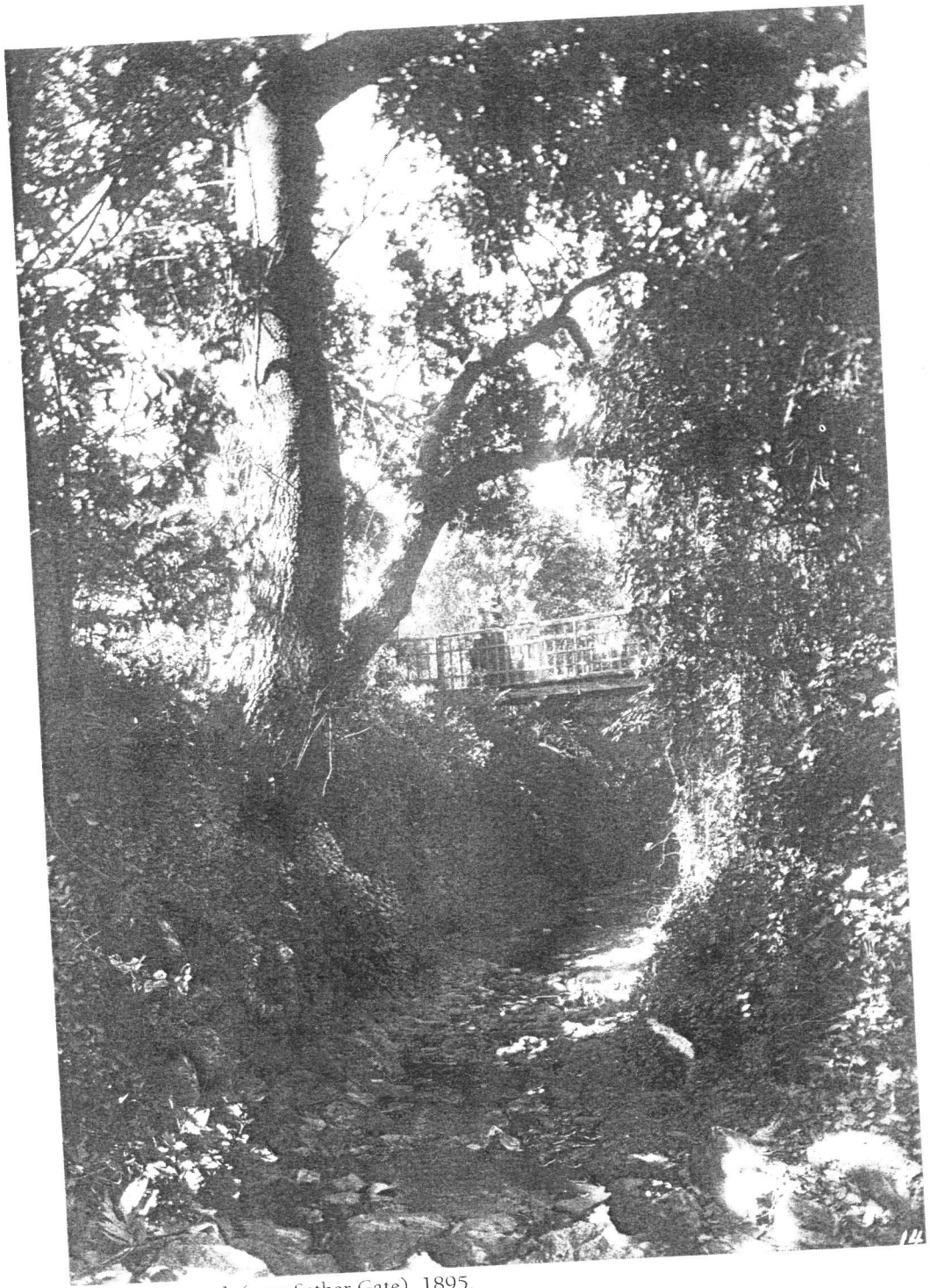
Formal and permanent instruction in botany was not established until 1890, however, with the appointment of Edward L. Greene, who almost immediately began to plan for a garden of native trees, shrubs and herbaceous plants native to California, which would complement Hilgard's "Garden of Economic Plants."

Within a few years there were as many as 1,200 plants in the university's garden, which occupied the swale north of the site of Doe Library, but propagation facilities on the west side of the north branch of Strawberry Creek were limited to small wooden sheds which had become highly inadequate.

In 1893 the regents approved a motion to build a new plant house, later referred to as the Conservatory, designed by Lord and Burnham of Irvington, New York. The new building was to have an interior area of some 6,000 square feet, and the central portion, the Palm House, was forty-five feet square with a height of forty-two feet. Construction was completed in 1894 at a cost of $20,000, on a site just north of the Botanical Garden, the present location of the Haviland



South and east façades of the Conservatory in 1900, with Botanical Garden plantings in the foreground. *University Archives (UARC PIC 10C:3).*



Bridge over creek (now Sather Gate), 1895.
University Archives (UARC PIC 2:151).