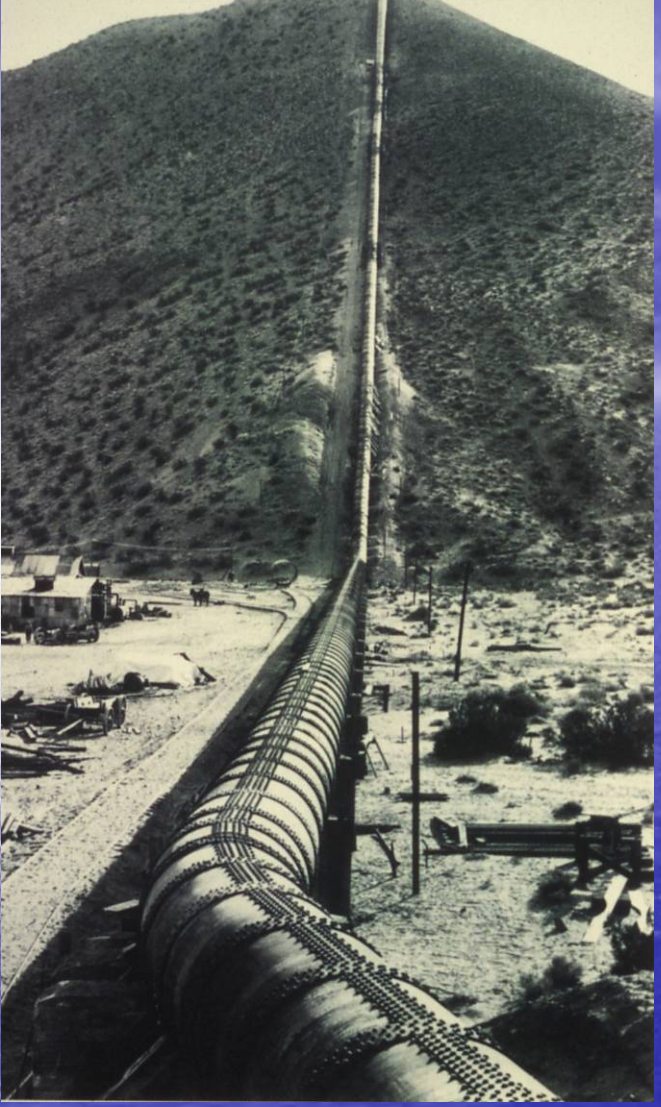
ORIGINS OF ENGINEERING GEOLOGY IN SOUTHERN CALIFORNIA

J. David Rogers, Ph.D., P.G., C.E.G., C.HG.
University of Missouri-Rolla

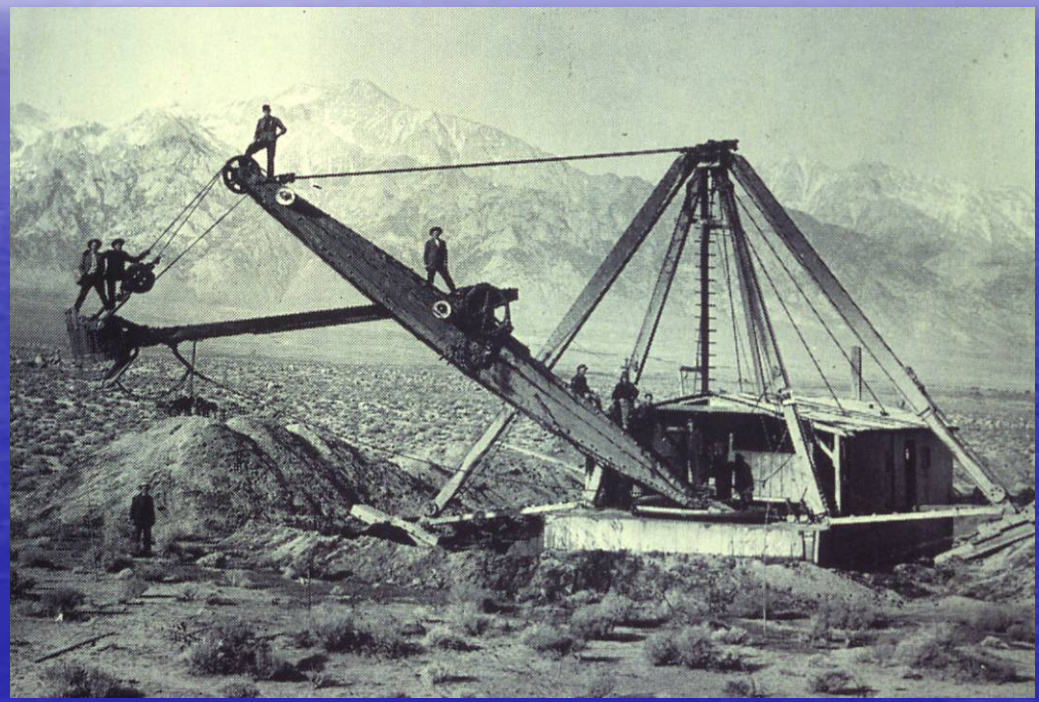
Keynote Presentation

for
2007 Annual Meeting
Association of Environmental and Engineering Geologists
Los Angeles, California
September 26, 2007

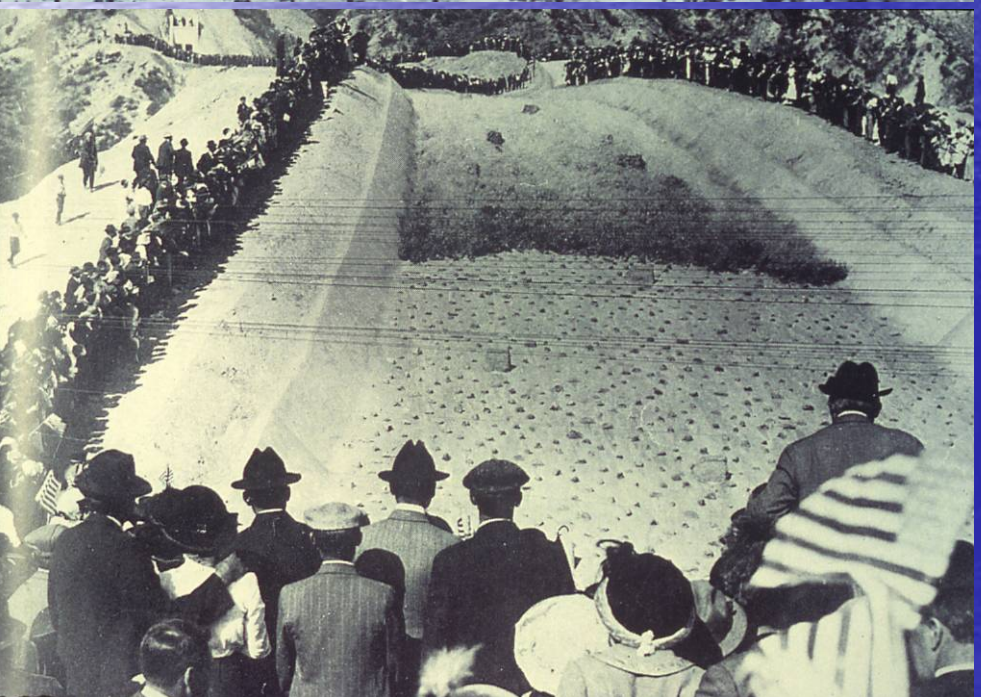
- The **Pacific Palisades around 1890**, showing the erodable nature of the bluffs and the Southern Pacific tracks leading to their pier at North Santa Monica Bay.
- Los Angeles began growing at an astounding rate in the 1880s, when the Southern Pacific and Santa Fe Railways both reached the city.



A thirsty city builds a colossal aqueduct 1906-13



- Los Angeles could not support more than about 250,00 people with its own water resources.
- In 1906 the citizens voted a $23 million bond ,measure to bring water 240 miles from the Owens River.



Water brought unprecedented growth after 1913

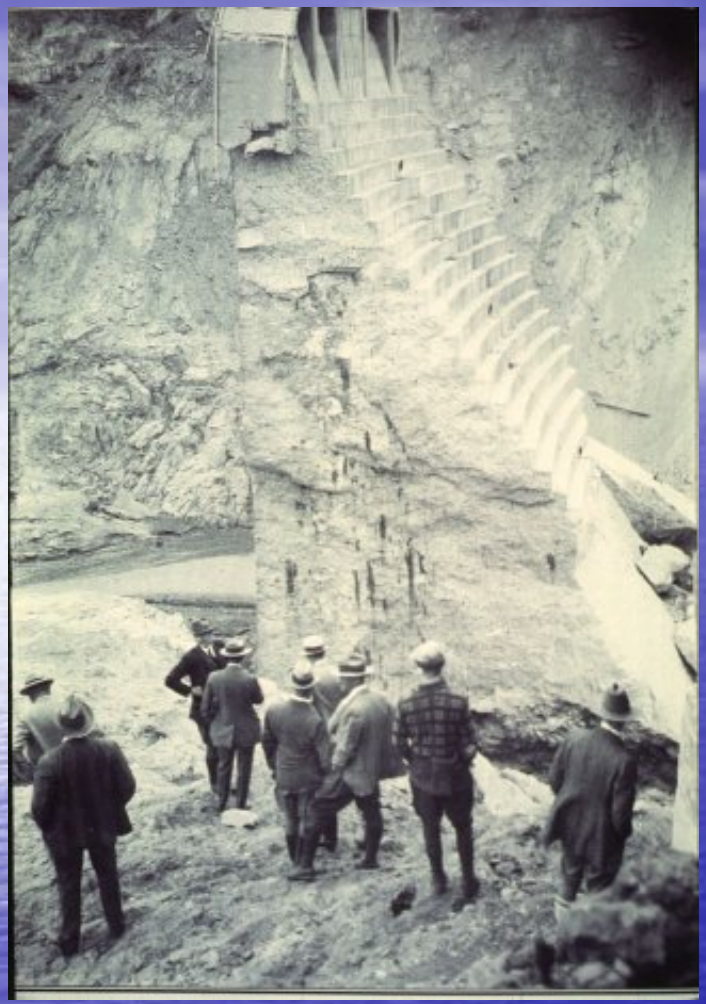
- 40,000 people turned out to see the first water from the Los Angeles Aqueduct cascade into the San Fernando valley in November 1913.
- William Mulholland said *“there it is, take it!”*

1926

- In January 1926 John Buwalda left his faculty position at Berkeley to develop an Earth Sciences program at the new California Institute in Pasadena.
- In May 1926 the Los Angeles Bureau of Waterworks & Supply completed construction of the 205 foot high St. Francis Dam in San Francisquito Canyon, 35 miles north of Los Angeles.
- Both of these events would have far-reaching implications

Commitment to Field Training

- The **Caltech geology program** began in 1926, under the leadership of **John Buwalda** (BS 1912; PhD 1915, U.C. Berkeley).
- During the junior year all students were required to take a year-long introductory field course, which met on weekends.
- Caltech required undergraduates to take two summer field camps; one between their junior and senior year, and another, after their senior year!
- Students were also required to complete a senior thesis that was based upon independent field mapping somewhere in southern California.



The flood waters killed between 432 and 600 people, and $9 million in property damage and wrongful death judgments.

- In March 1928 the St. Francis Dam failure brought national attention to the need for geologic input in the siting, deign, and construction of critical structures.
- Its impact on the civil engineering profession, and in particular, dam engineering, was enormous.

The geology profession speaks out

- Professor Leslie Ransome of Caltech was named to the Governor's Commission to Investigate the St. Francis Dam Failure
- He focused the panel on the complex foundation conditions, including the San Francisquito fault

- In the wake of the St. Francis failure the American Society of Civil Engineers convened a special Symposium on High Dams in San Diego in October 1928.
- Ransome was one of four invited state-of-the-practice papers, titled: High Dams: The Viewpoint of the Geologist, published in the 1929 ASCE Proceedings
- These articles and the ensuing discussions took 102 pages of the Society's 1931 Transactions

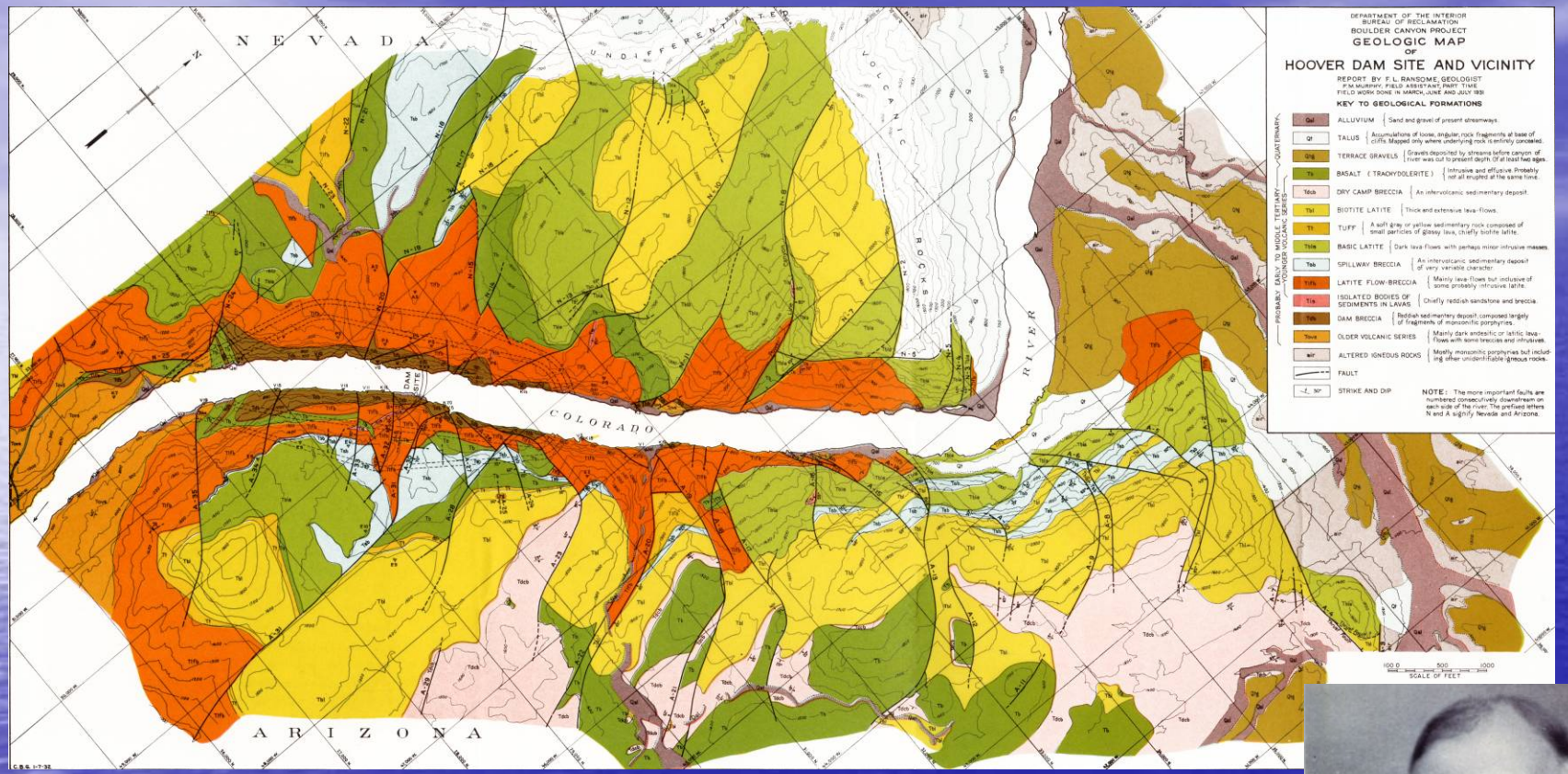
In the wake of St. Francis, engineering geologic input became mandatory for all new dams

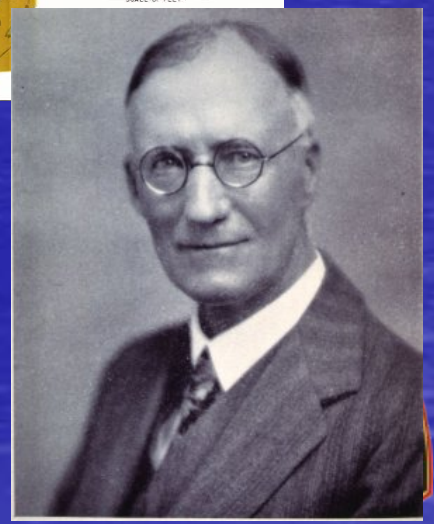
Frank Nickel

- The Bureau of Reclamation hired Dr. Frank A. Nickel, a Caltech graduate, in 1931 as their first full-time engineering geologist, to work at Hoover Dam
- The Corps of Engineers hired E.B. Burwell, Jr. as their first engineering geologist in 1931

- In 1933 the Tennessee Valley Authority hired their first engineering geologist
- In 1934 the California Division of Water Resources was established, hiring a staff of five engineering geologists (which grew to 134 by 1968)

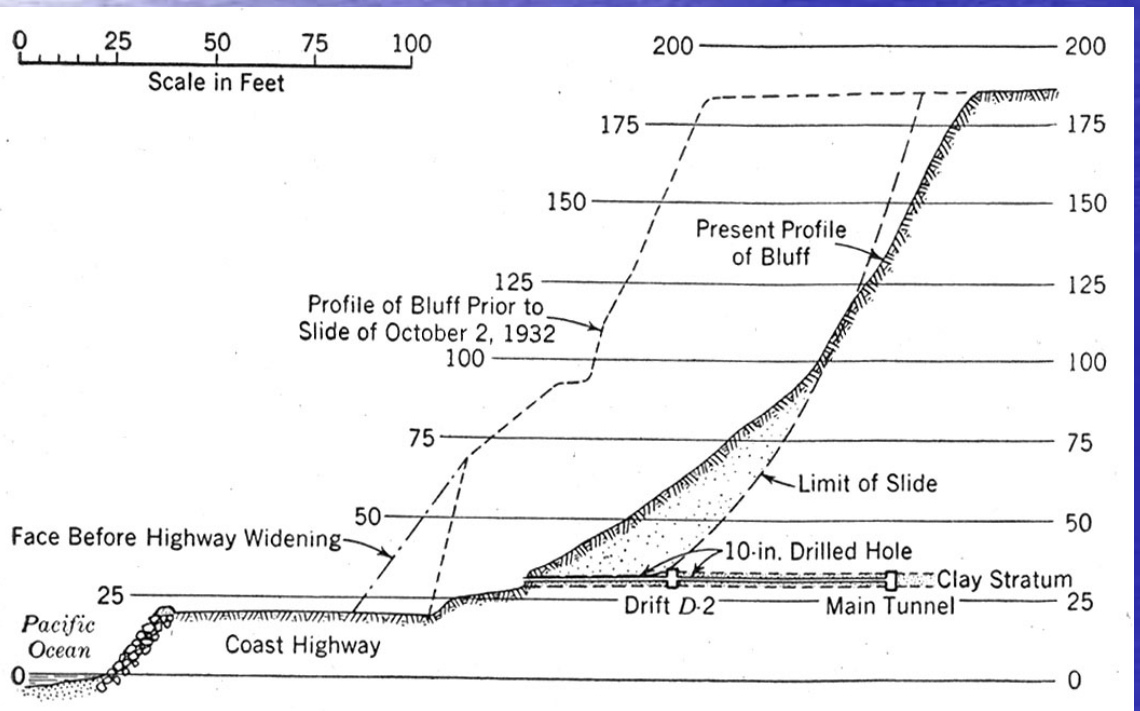
Ransome mapped Hoover Dam site





- In 1930 the Bureau of Reclamation asked **Professor Ransome** to make a detailed assessment of the geologic conditions at the Hoover Dam site in Black Canyon.
- This site had been identified by **Homer Hamlin** in 1920, one of the first engineering geologists in the USA, and the City Engineer of Los Angeles between 1912-17.

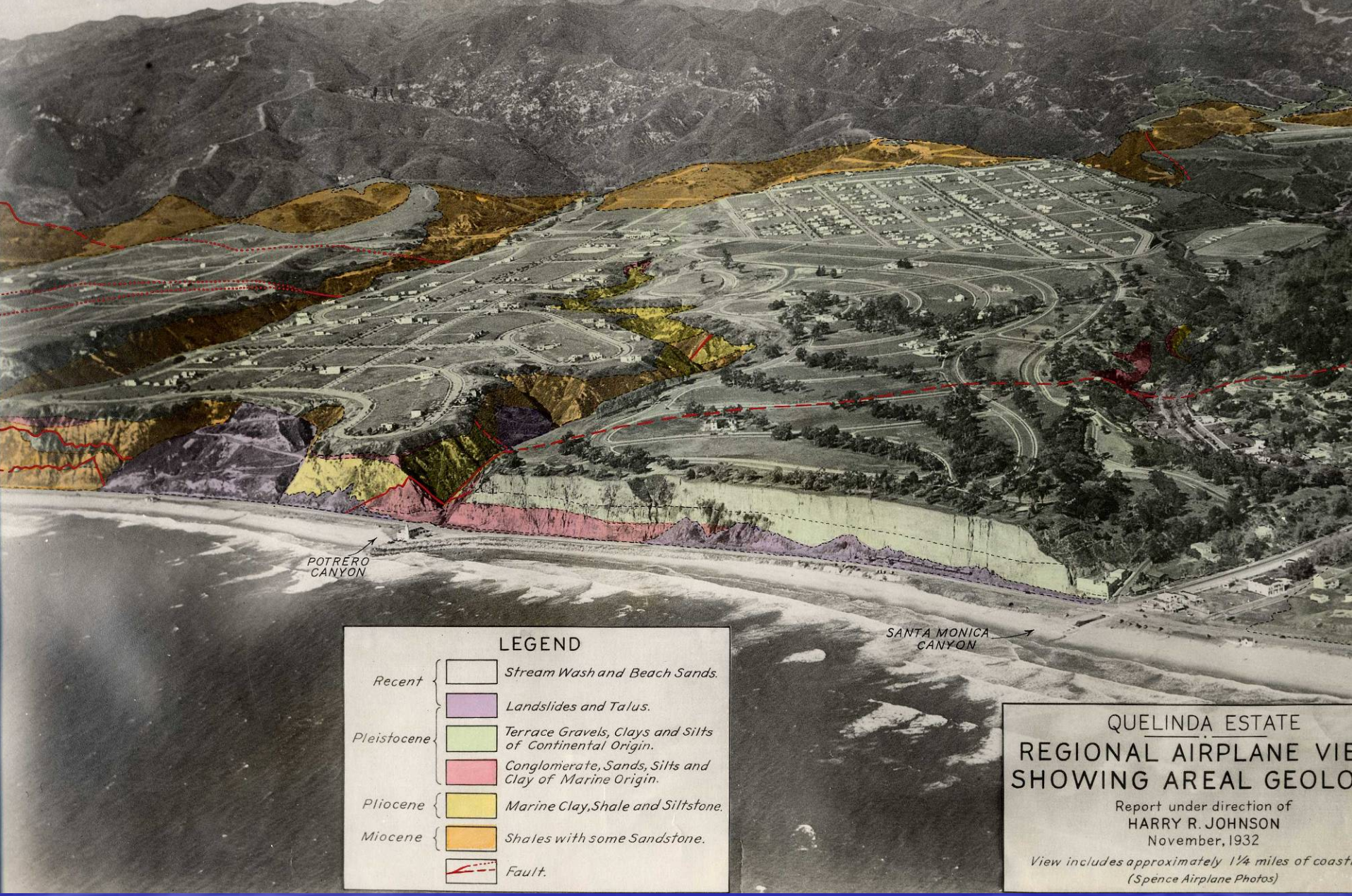
- **Los Angeles prospered more than most American cities during the Great Depression of 1929-41 because of the film, petroleum, aircraft, and citrus industries. Residential development soon spread to the picturesque coastline.**



1932 Quelinda Estate Landslide

- The Quelinda Estate slide shut down Pacific Coast Highway in 1932.
- Los Angeles engineer Robert A. Hill attacked the clay seam at the base of the cliffs using hot air to desiccate the clay

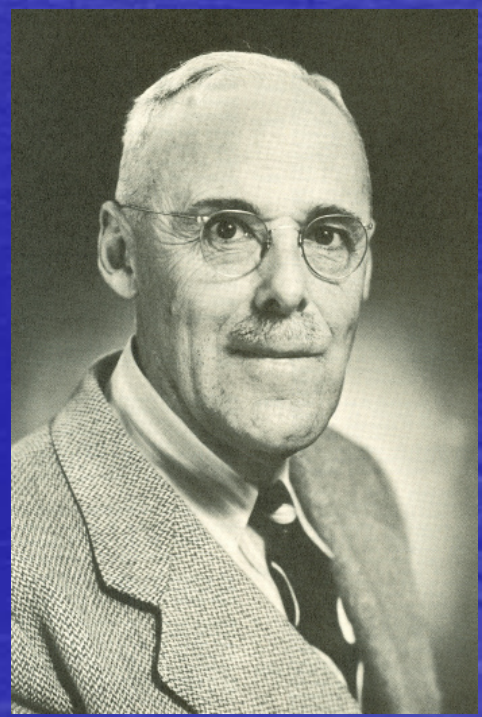
- **The Quelinda Estate project was one of the earliest geologic appraisals of landslippage in southern California in November 1932. The first was the Point Fermin Slide of 1929.**



- **Consulting geologist Harry R. Johnson used aerial photo overlays to illustrate the geologic conditions along 1-/34 miles of coastline, shown here.**

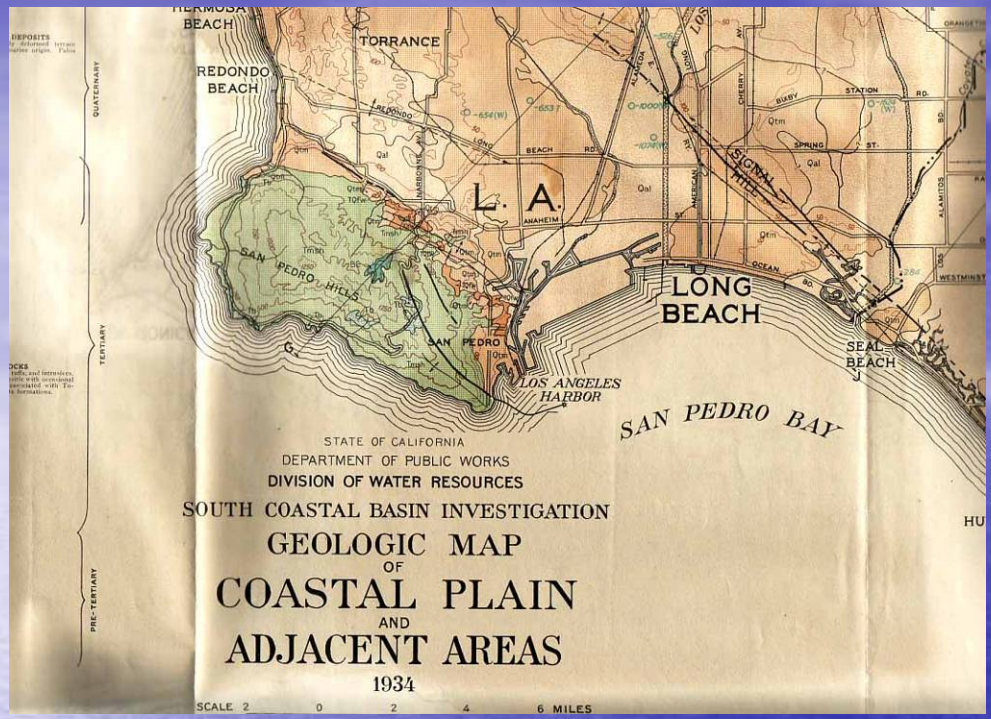
- In 1928 the Metropolitan Water District began engaging Leslie Ransome. In 1931 they beagn using John Buwalda (right below) to advise them in planning their 241-mile long Colorado River Aqueduct across the Mojave Desert

The aqueduct included 92 miles of tunnel and was constructed between 1934-37



The Caltech geology faculty in 1936

- Within his first decade as chair, John Buwalda succeeded in attracting an inspiring array of talent, including: Leslie Ransome, W.P. Woodring, Ian Campbell, Charles Richter, Hugo Benioff, Beno Gutenberg, and soon, Dick Jahns.

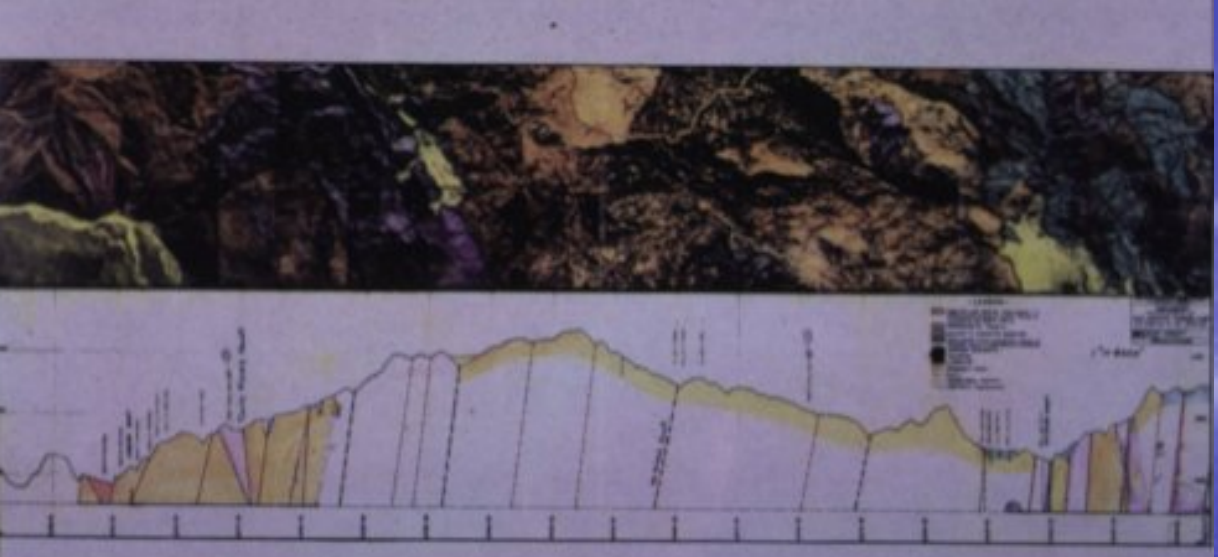


Rollin Eckis (1905-1999) groundwater pioneer

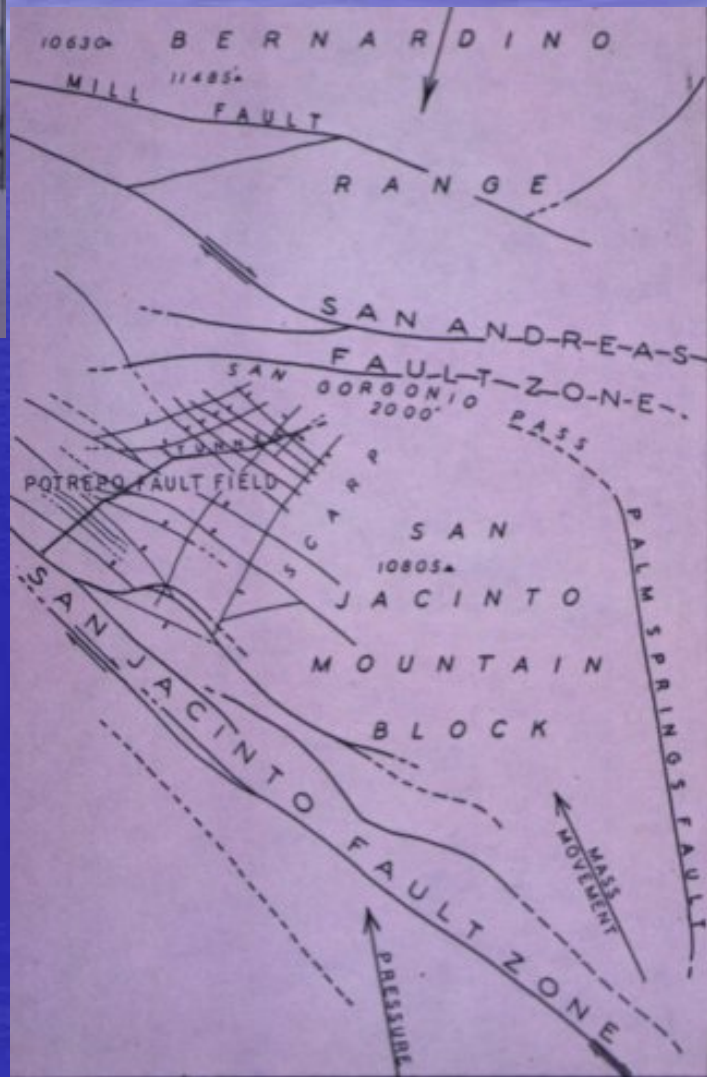
- **Rollin Eckis** received his BS in geology from Pomona College in 1927 and MS from Caltech in 1929. He began his doctorate at Cal Tech, but the stock market crash of October 1929 forced him to withdraw a year later.
- In 1930 he received a post-graduate research fellowship at Pomona College, where he continued his research on the geology and groundwater storage capacity of the **South Coastal Basins** around Los Angeles
- This work was subsequently published by the newly-formed State Division of Water Resources as Bulletin 45 in 1934. It became one of the seminal documents on understanding groundwater basins and water resources in southern California.

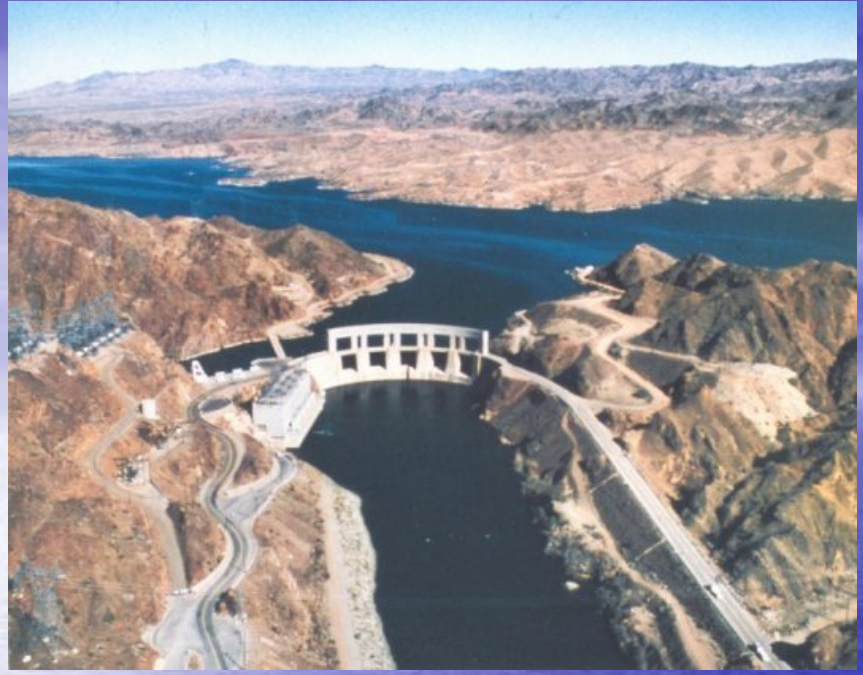
- John Buwalda also played an important role in developing earthquake resistant building codes, following the April 1933 M6.3 Long Beach earthquake, by providing numerous interviews to newspapers in support of the **Riley and Field Acts**, passed that year by the State Legislature.

MWD San Jacinto Tunnel 1935-37



Record inflows of 16,000 gpm delayed work when the tunnel encountered the Potrero fault field





Parker Dam

Lake Matthews

- John Buwalda succeeded Ransome as the preeminent engineering geologic consultant for MWD in 1935.
- Over the next two decades he produced a series of reports containing remarkable insights on the physiographic setting of project sites which have been remarkably prophetic.

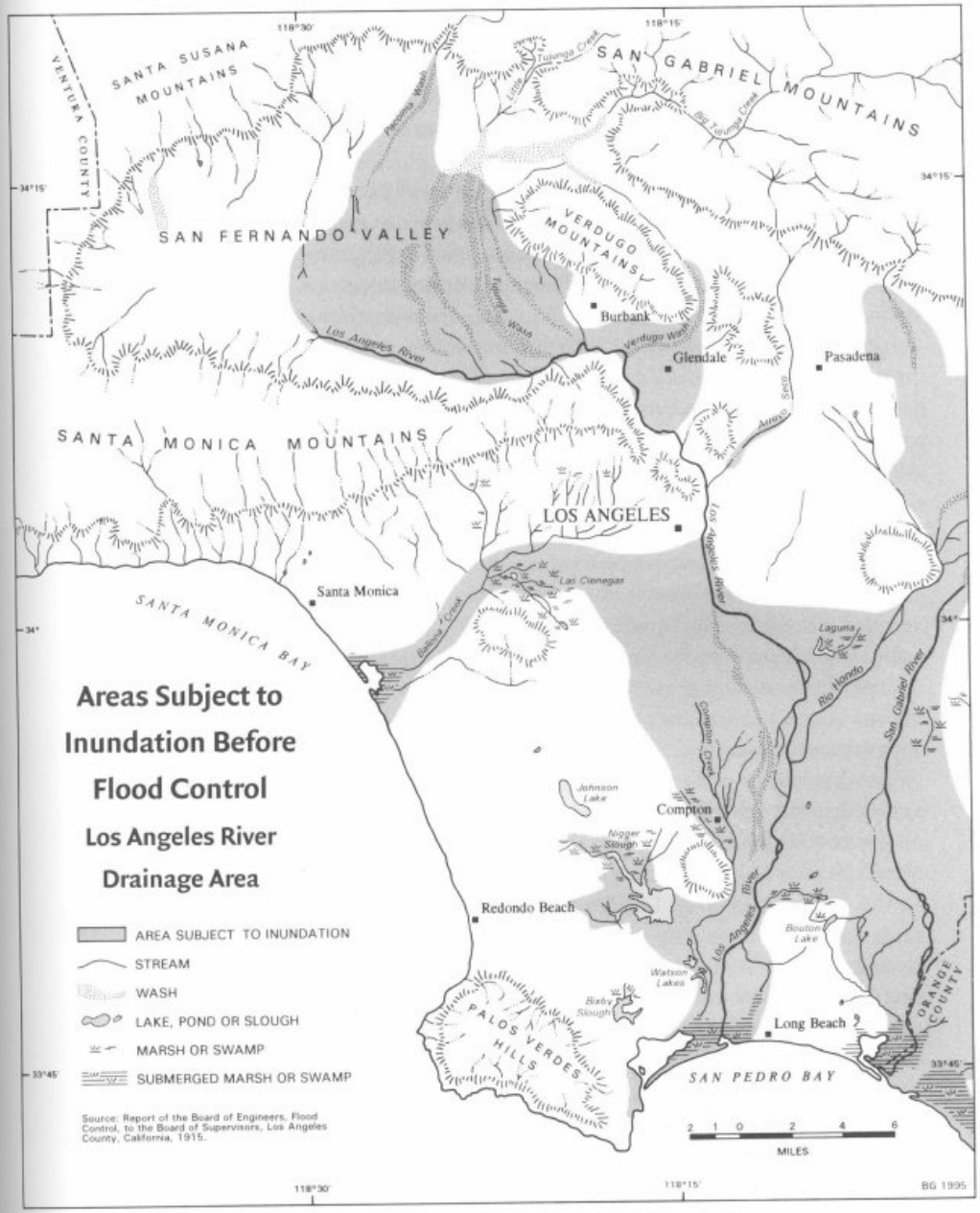


FIG. 4.2. More than 336 square miles of Los Angeles County were threatened by floods before a comprehensive flood control program was developed. Map by the author.

1938 Flood

- A series of intense storms struck southern California in early March 1938, causing unprecedented levels of damage and inundating enormous tracts of land, shown here.

- **Virtually all of Orange County west of the Santa Ana River was inundated in March 1938**

Los Angeles River

Pacific Electric bridge on San Gabriel fan

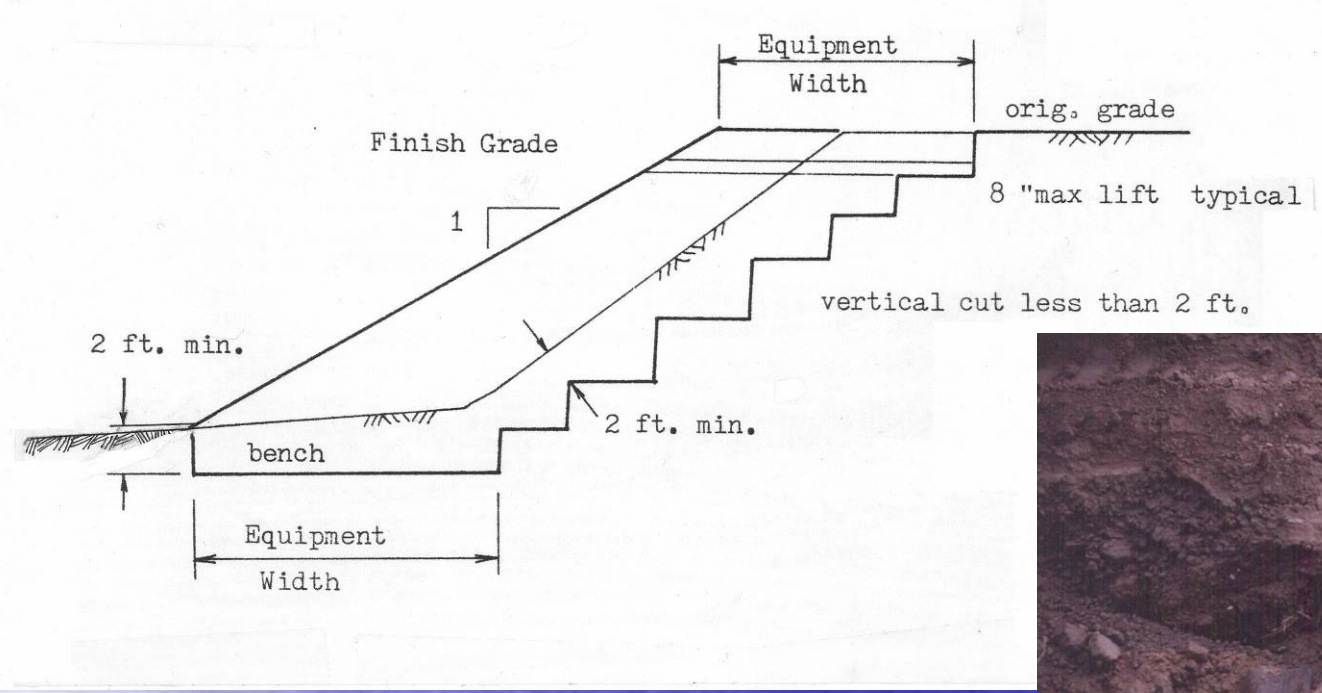
- Concrete facings along the Los Angeles River were undercut by bed scour during high flow, severing all passenger rail connections with Los Angeles
- Many of the heavy bridges were dropped by bed scour during the highest flows.

- **Caltech Division of Geology in 1941.** By this time John Buwalda he had succeeded in assembling the largest and most diverse geology department in the United States, at one of the nation's smallest schools.

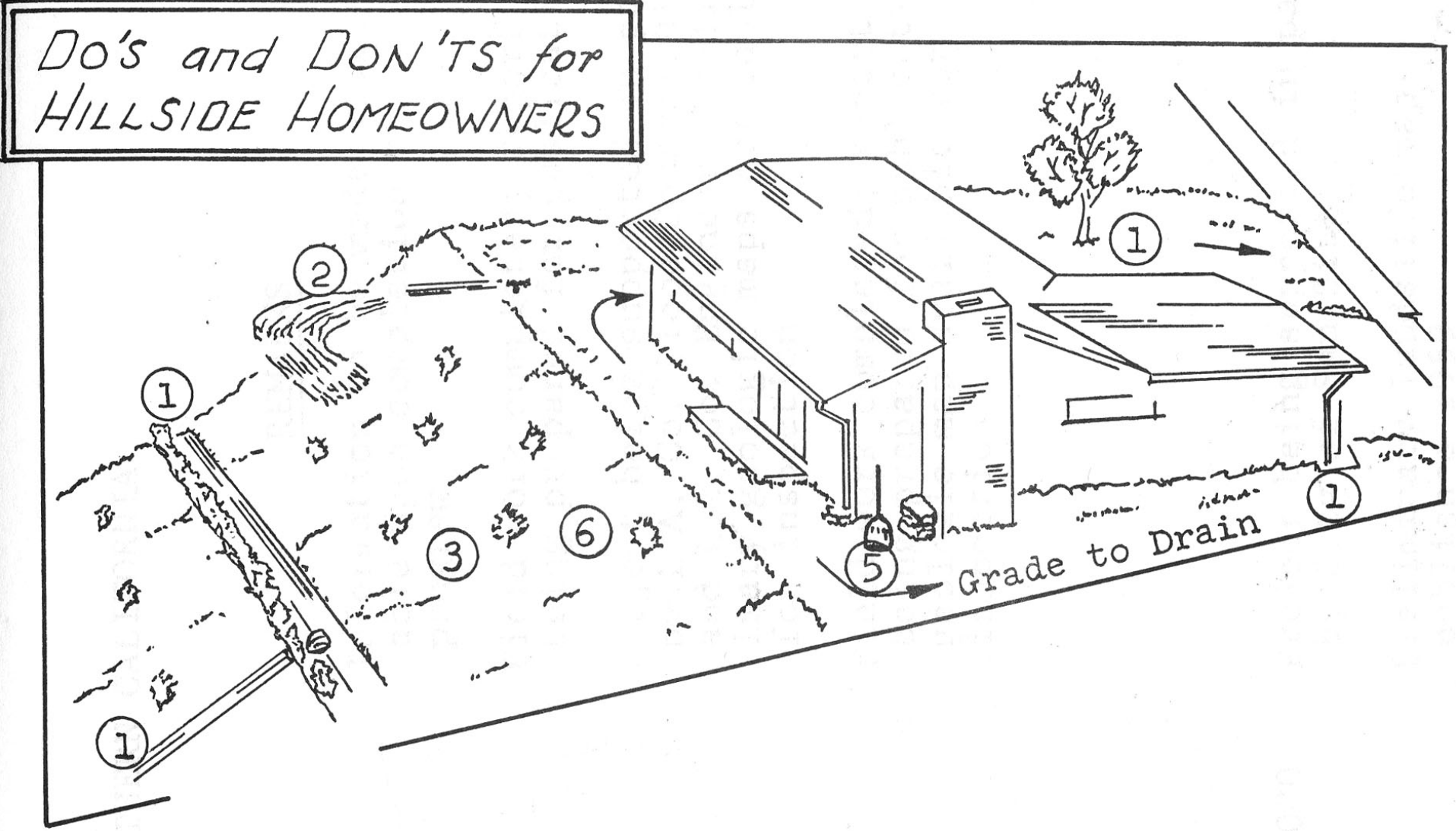
- During World War II the port of Los Angeles-Long Beach expanded greatly and problems with settlement around Terminal Island began to manifest themselves.

- Heavy storms in January 1952 caused $7.5 million in property damage to homes in the City of Los Angeles
- This resulted in the City adopting the first excavation and grading ordinance in the United States that same year.

1952 code



- The 1952 grading code was fairly basic by modern standards. It called for removal of organics, keying and benching at least 2 feet below native grade into “competent material”, 1:1 cut slopes and 1.5:1 fill slopes.



- **Handout developed by the City of Los Angeles Department of Building & Safety in the 1950s.**

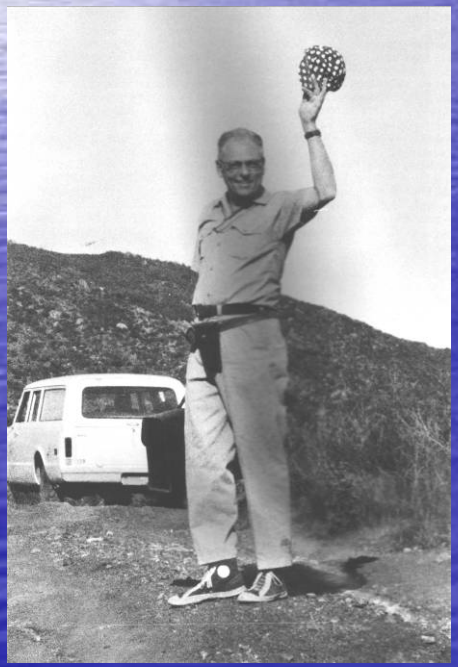
	AGENCY	ADMINISTRATIVE DATA					CUTS		FILLS				
		YEAR ORDINANCE ENACTED	GEOLOGIC REPORT REQUIRED		GEOLOGIC INSPECTION DURING DEVELOPMENT	QUALIFIED GEOLOGIST LIST ESTIBLISHED	MAXIMUM SLOPE ALLOWED	EXCEPTION PERMITTED	MAXIMUM SLOPE ALLOWED	EXCEPTION PERMITTED	BENCHING		
			TRACT	SINGLE LOT							MINIUM WIDTH AT TOE	MAXIUM SLOPE-BENCH NOT REQ.	EXCEPTION PERMITTED
MUNICIPAL	ALHAMBRA BLDG. DEPT.	1958	R	NO	NO	NO	2:1	YES	2:1	YES	DETERMINED BY ENGINEER		
	ANAHEIM ENG. DIV.-PUB. WKS. DEPT.	1963	YES	O	YES	NO	1.5:1	YES	1.5:1	YES	NS	NS	NS
	BEVERLY HILLS BLDG. DEPT.	1952 1959A	U	F	U	NO	1:1	YES	1.5:1	YES	PROFESSIONAL RECOMMENDATION		
	BURLINGAME PUB. WKS. DEPT.	ND	NO	NO	NO	NO	1.5:1	NO	2:1	NO	ND	ND	ND
	BURBANK PUB. WKS. DEPT.	1954 1961A	U	O	U	NO	1:1	YES	1.5:1	YES	VARIES	VARIES	ND
	CHULA VISTA ENG. DEPT.	ND	NO	NO	NO	NO	1:1	YES	2:1	YES	NS	NS	NS
	EL CAJON ENG. DEPT.	ND	NO	NO	NO	NO	1.5:1	YES	2:1	YES	NS	NS	NS
	GLENDALE ENG. SEC.	1954 1960A	U	O	U	YES	1:1	YES	1.5:1	YES	10'	5:1	NO
	LAGUNA BEACH DEPT. B&S.-ORANGE CO.	1965	YES	ND	ND	NO	1.5:1	YES	1.5:1	YES	5'MIN.	5:1	NO
	LA MESA ENG. DEPT.	ND	NO	NO	NO	NO	NS	NS	NS	NS	NS	NS	NS
	LOS ANGELES GRAD. DIV., DEPT. B.&S.	1959 1965A	YES	YES	YES	YES	2:1	YES	2:1	YES	NO	5:1	NO
	MARTINEZ ENG. DEPT.	1959	U	R	U	NO	1:1	YES	1.5:1	YES	10'	5:1	YES
	MONROVIA BLDG. DEPT.	1961	O	R	R	NO	1:1	NO	1.5:1	NO	VARIES	5:1	NO
	MONTEREY PUB. WKS. DEPT.	1961	ND	ND	R	NO	NS	NS	NS	NS	NS	NS	NS
	ORANGE ENG. DIV.-DEPT. PUB. WKS.	1964	YES	O	NO	NO	1.5:1	NO	1.5:1	NO	10'	5:1	YES
	PALO ALTO ENG. SEC.	1962	U	ND	ND	YES	1:1	YES	1.5:1	YES	NS	NS	NS
	PASADENA BLDG. DEPT.	1953	O	R	R	NO	1:1	YES	1.5:1	YES	ND	ND	ND
	RICHMOND PUB. WKS. DEPT.	ND	U	U	U	NO	1.5:1	YES	2:1	YES	NS	5:1	YES
	RIVERSIDE PUB. WKS. DEPT.	1963	NO	NO	NO	NO	1.5:1	YES	2:1	YES	NS	4:1	ND
	SAN BERNARDINO DEPT. PUB. WKS.	1965 (TENTATIVE)	CITY ENGR'S. DISCRETION			NO	1.5:1	YES	1.5:1	ND	5'MIN.	5:1	ND

ABBREVIATIONS USED:

U — USUALLY
F — FREQUENTLY
O — OCCASIONALLY
R — RARELY
H — SLOPE HEIGHT
NS — NO STANDARD REQUIREMENT
ND — NO DATA OBTAINED
A — AMENDED

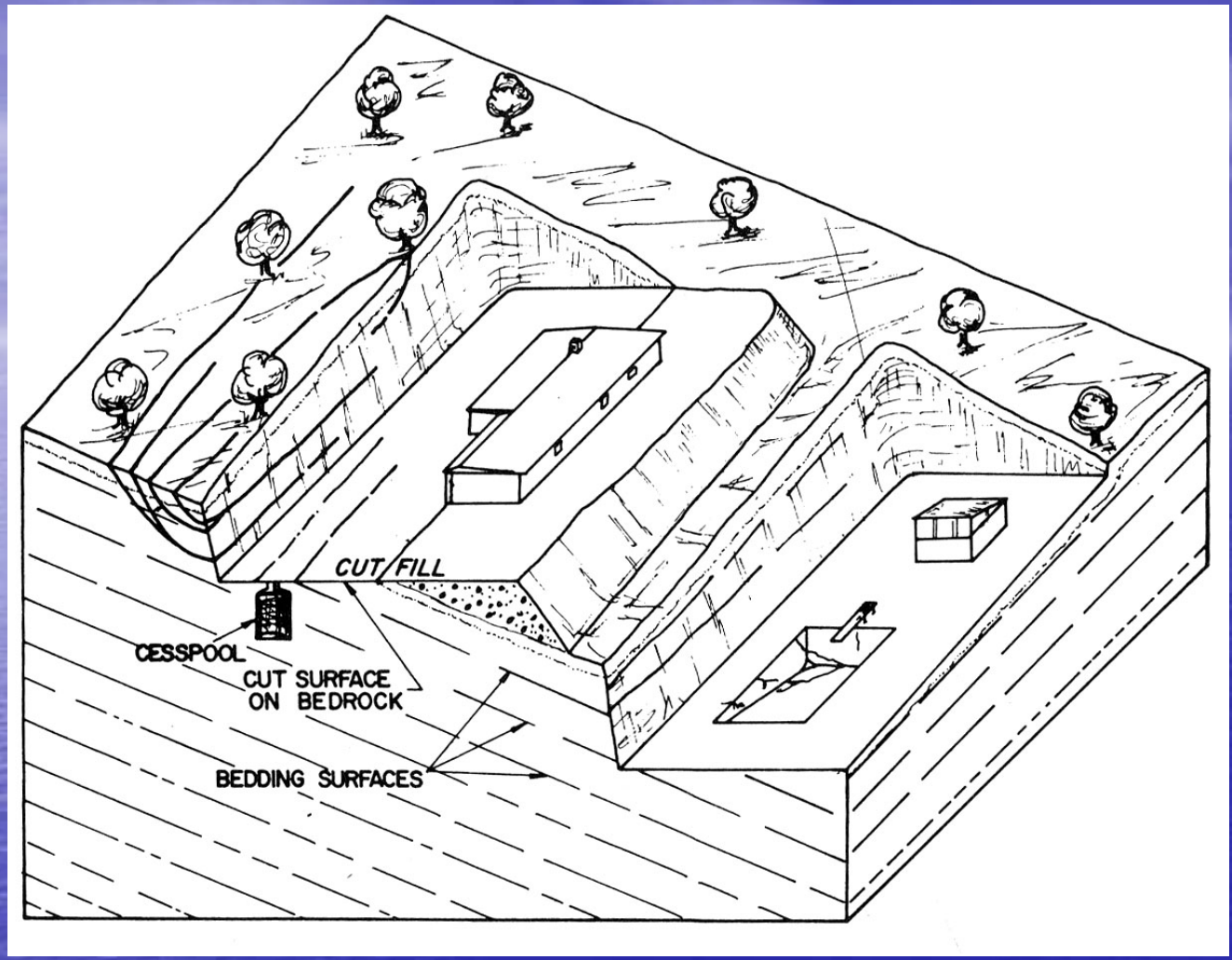
EXPLANATION OF SLOPE DAT

- Between 1946-61 one of every seven homes built in the United States was in the City of Los Angeles, and one in every four in Los Angeles County.
- Jim Slosson said they were designed with a “quick, hot and dry” mentality, with little consideration of drainage or geologic setting.

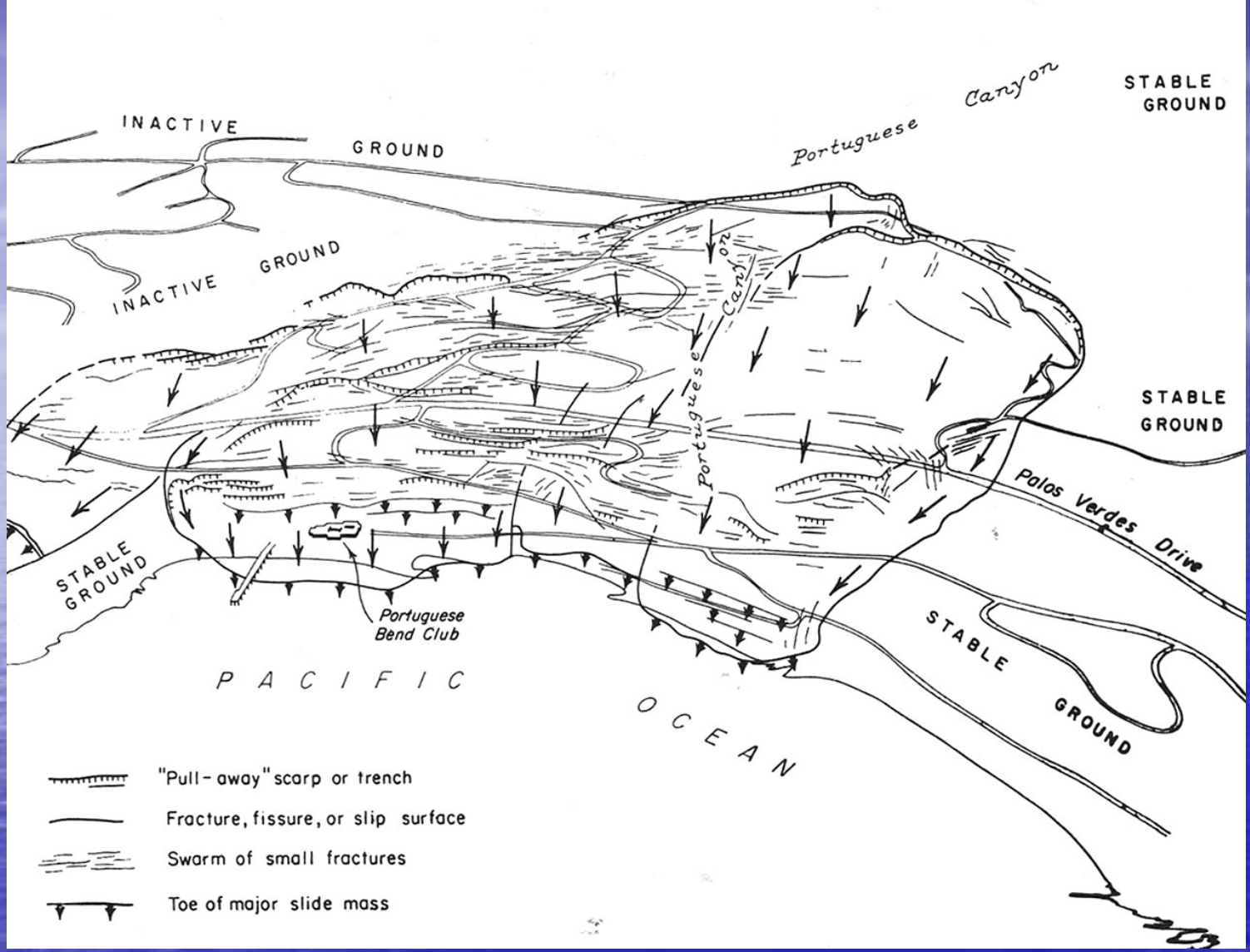


Richard H. Jahns

- When John Buwalda died of a heart attack in August 1954, Dick Jahns succeeded him as the preeminent engineering geologic consultant in southern California, the third influential persona from the Caltech geology program.
- Dick was one of the central figures in providing technical input for grading and excavation ordinances in Los Angeles until he departed in 1960.



- **Being an educator, Dick Jahns was a skilled artist and communicator. This shows one of his conceptual sketches for do's and don'ts of constructing homes on hillsisdes.**



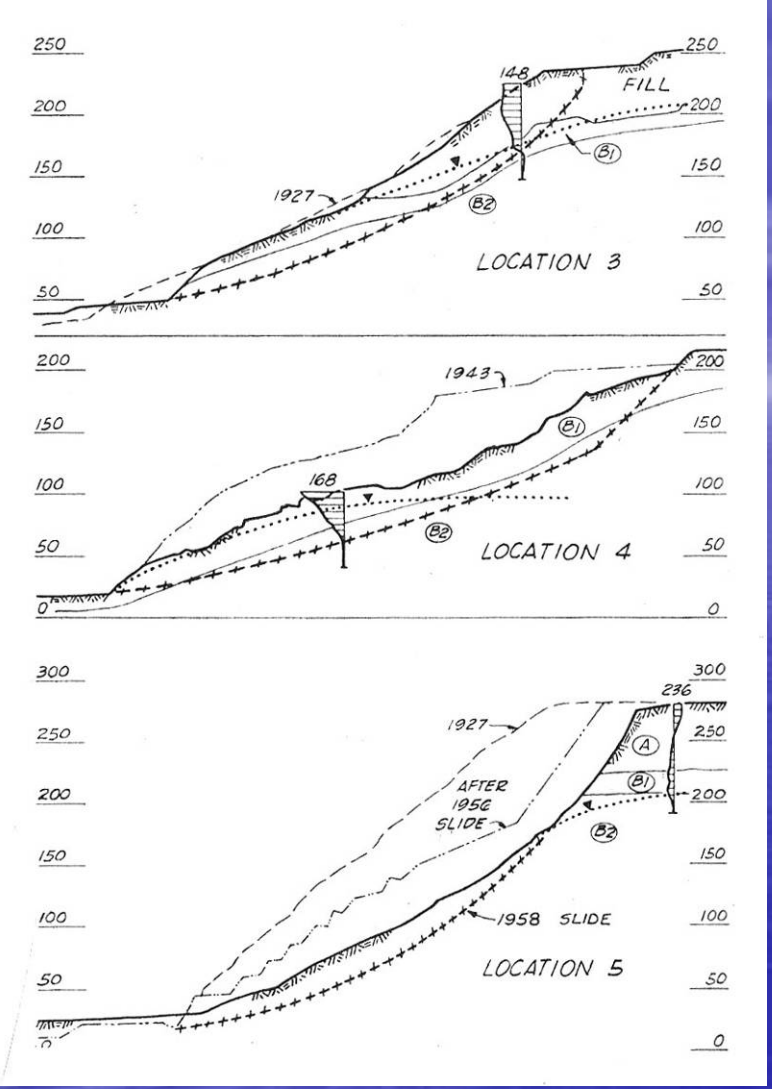
- **The Portuguese Bend Landslide activated in 1956, encompassing a wide area with 132 recently built homes.**

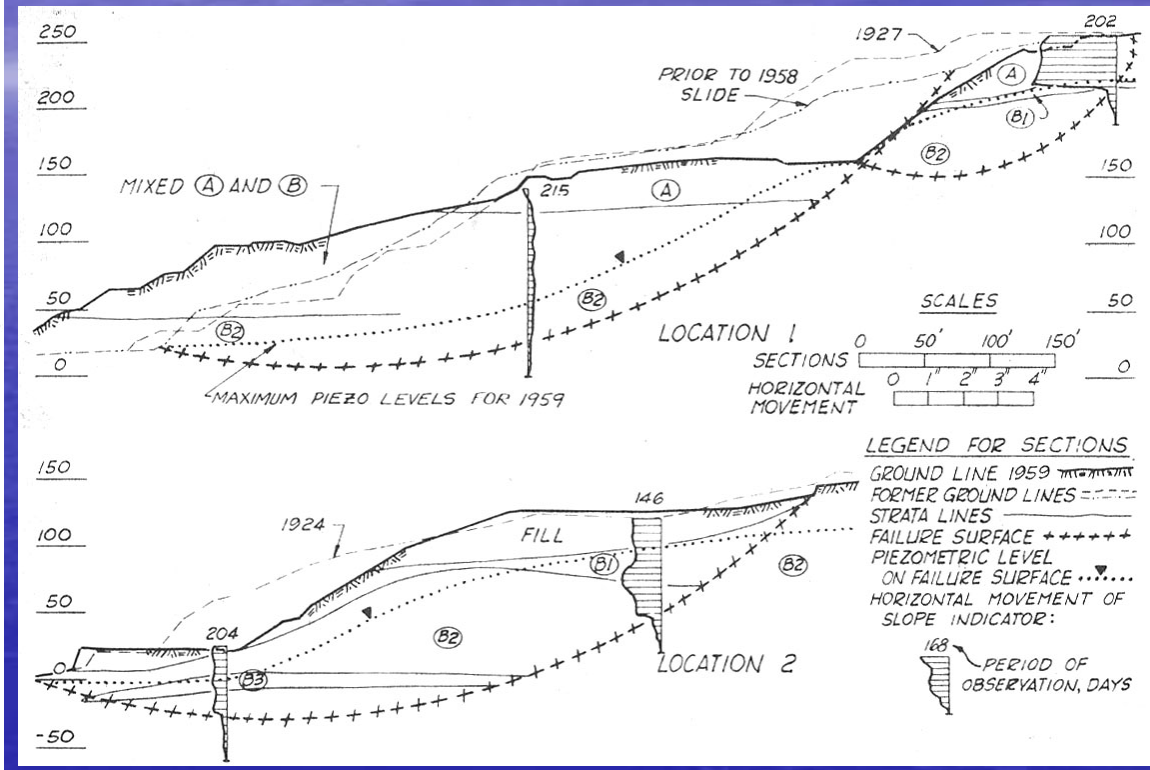
Dennis Evans

- Shortly after the Portuguese Bend Landslide reactivated in 1956, Los Angeles County was drawn into costly litigation, which they lost in 1961.
- In 1959 the County hired their first engineering geologist, **Dennis Evans**

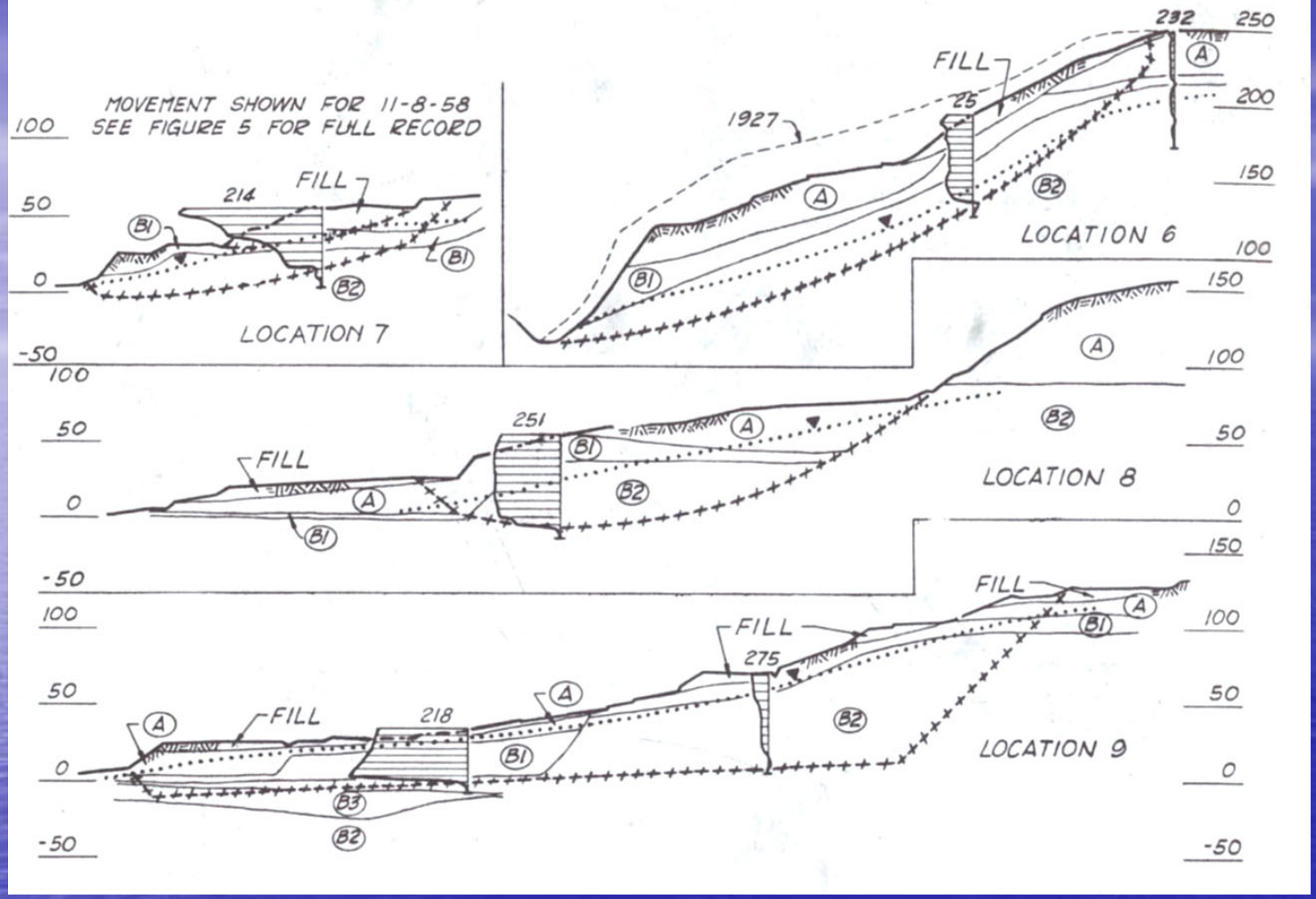
- The 1958 Via de Las Olas Landslide in Pacific Palisades closed Pacific Coast Highway and drew the City of Los Angeles into costly litigation.
- The City hired Moran, Proctor, Mueser & Rutledge of New York to make a comprehensive 2-year study, which included mapping slides along 15 miles of coastline

Via de Las Olas slope stability studies





- Jim Gould headed up the team at Mueser-Rutledge that back-analyzed the Pacific Palisades slope failures. These studies were published in 1960 and formed the basis for all subsequent assessments in the southland.



- **The Mueser-Rutledge study also examined mitigation options. Recompacted buttress fills became the standard mass grading technique in southern California and the Via de Las Olas slide became a city park.**

Rolling Hills Estates- July 1960

- In those days geo disasters were occurring with increasing frequency. This shows a massive slide on Rockbluff Drive in Rolling Hills that began moving in the spring of 1960.

CAEG

- This shows an old membership application for the California Association of Engineering Geologists.
- AEG played a pivotal role in the qualifications and licensure of engineering geologists.

CALIFORNIA ASSOCIATION OF ENGINEERING GEOLOGISTS

Application Form for Member or Associate Member

Name C. MICHAEL SCULLIN Date JULY 7, 1963

Address 4106 DUNSMORE AVE App. for Member: ✓ Associate Mem. ___

LA CRESCENTA CALIF. Prof. Societies and Licences G.S.A., A.S.C.E., A.E.G., SIGMA GAMMA EPSILON, ENGINEERING GEOLOGIST LICENCE - CITY of L.A.

Date of Birth MAR. 5, 1932

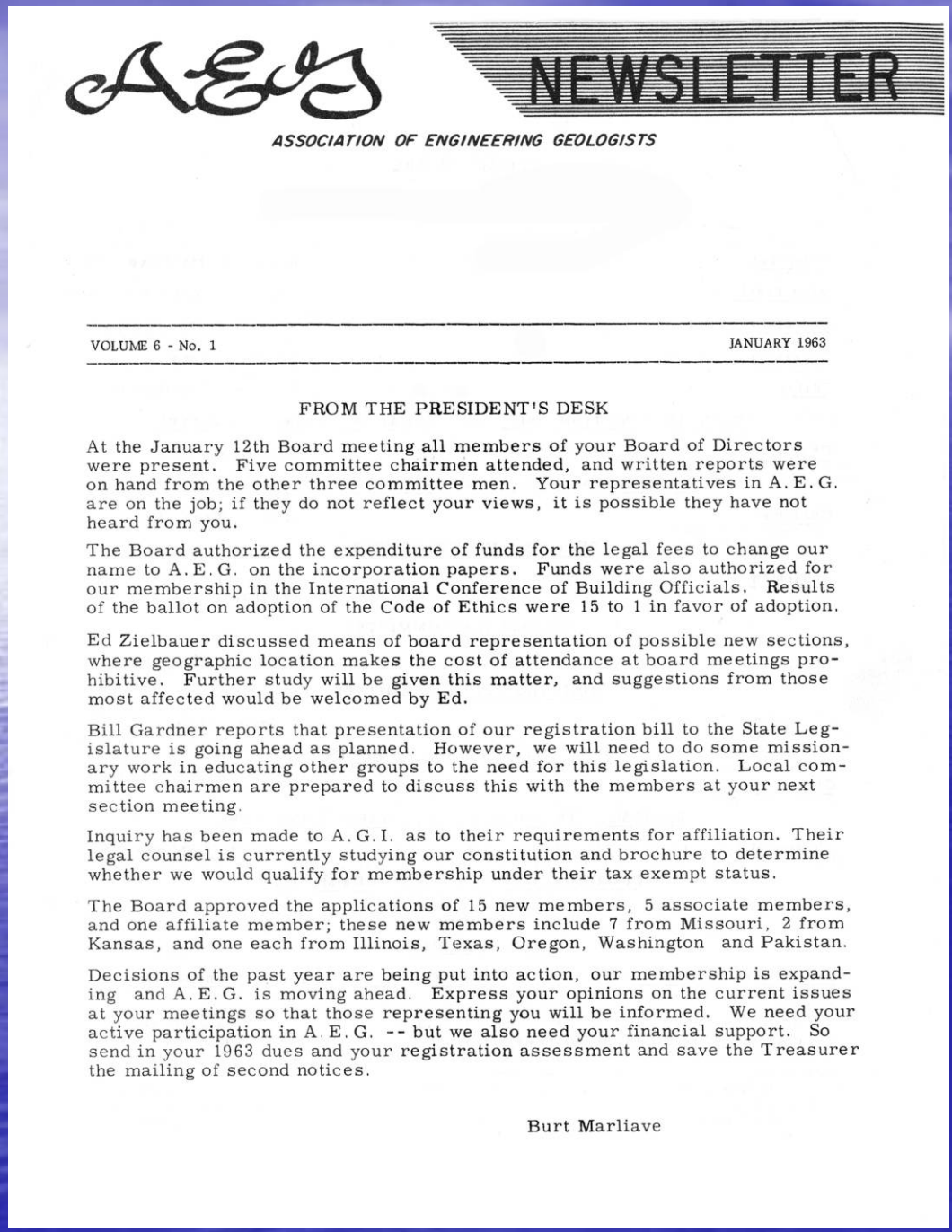
EDUCATION

Date From	Date To	College or University (Name and Address)	Major Subject	Semester Hours Credit, Geology		Degree and Date
SEPT 1950	JUNE 1952	SOUTHERN ILLINOIS UNIV. CARBONDALE, ILLINOIS	INDUSTRIAL MANAGEMENT & ARCHITECTURE	6 3/3	NONE	NONE
SEPT 1952	JAN 1963	TEXAS WESTERN UNIV. EL PASO, TEXAS	"	10	NONE	NONG
JAN 1956	AUG 1958	ARIZONA STATE UNIV. TEMPE ARIZONA	GEOLOGY	119	45	B.S. DEGREE JULY 1958
FEB 59 - JUNE 60		U.C.L.A. EXTENSION-L.A.	MATH	9	NONE	NONE
SEPT 60 - PRESENT		UNIV. SO. CALIF. - L.A.	ENGR. GEOL.	11	11	WORKING TOWARD M.S. IN ENGR. GEOL.

EXPERIENCE

(Begin with most recent and describe duties in detail)

From Mo. Yr.	To Mo. Yr.	Job title and description of duties performed	Employer (name and type of business) Name supervisor and indicate if eng. geol., civil eng., or other
JAN 1963	PRESENT	ENGINEERING GEOLOGIST IN CHARGE OF ALL EXCAVATION GRADING, DRAINAGE & EROSION CONTROL, & GEOL. HAZARDS IN THE UNINCORPORATED AREA OF ORANGE COUNTY; REVIEW ALL GEOLOGIC & SOILS REPORTS ETC.	GRADING SECTION DEPT. OF BLDG. & SAFETY COUNTY OF ORANGE 400 W. 8th STREET SANTA ANA, CALIF. FLOYD G. McLELLAN - SR. CIVIL ENGR.
MAR. 1959	JAN 1963	ENGINEERING GEOLOGIST IN CHARGE OF ALL HILLSIDE DEVELOPMENT IN CITY OF GLENDALE - EXCAVATION, GRADING, DRAINAGE & EROSION CONTROL, & GEOL. HAZARDS	GRADING SECTION OFFICE OF CITY ENGINEER CITY of GLENDALE 120 N. HOWARD ST. GLENDALE 6, CALIF. A.E. DUNFORD - CIVIL ENGR.
AUG. 1958	FEB 1959	ASSISTANT GEOLOGIST ELECTRIC & GAMMA RAY LOGGING OF WATER WELLS & ENGR. BORINGS, GROUND WATER DEVELOPMENT, SLOPE STABILITY & STRATIGRAPHIC PROBLEMS.	ASSOCIATED STRATIGRAPHIC SERVICES 11950 SAN VICENTE BLVD. L.A. 49, CALIF. JOHN FOSTER - GEOLOGIST



AEG NEWSLETTER

ASSOCIATION OF ENGINEERING GEOLOGISTS

VOLUME 6 - No. 1 JANUARY 1963

FROM THE PRESIDENT'S DESK

At the January 12th Board meeting all members of your Board of Directors were present. Five committee chairmen attended, and written reports were on hand from the other three committee men. Your representatives in A.E.G. are on the job; if they do not reflect your views, it is possible they have not heard from you.

The Board authorized the expenditure of funds for the legal fees to change our name to A.E.G. on the incorporation papers. Funds were also authorized for our membership in the International Conference of Building Officials. Results of the ballot on adoption of the Code of Ethics were 15 to 1 in favor of adoption.

Ed Zielbauer discussed means of board representation of possible new sections, where geographic location makes the cost of attendance at board meetings prohibitive. Further study will be given this matter, and suggestions from those most affected would be welcomed by Ed.

Bill Gardner reports that presentation of our registration bill to the State Legislature is going ahead as planned. However, we will need to do some missionary work in educating other groups to the need for this legislation. Local committee chairmen are prepared to discuss this with the members at your next section meeting.

Inquiry has been made to A.G.I. as to their requirements for affiliation. Their legal counsel is currently studying our constitution and brochure to determine whether we would qualify for membership under their tax exempt status.

The Board approved the applications of 15 new members, 5 associate members, and one affiliate member; these new members include 7 from Missouri, 2 from Kansas, and one each from Illinois, Texas, Oregon, Washington and Pakistan.

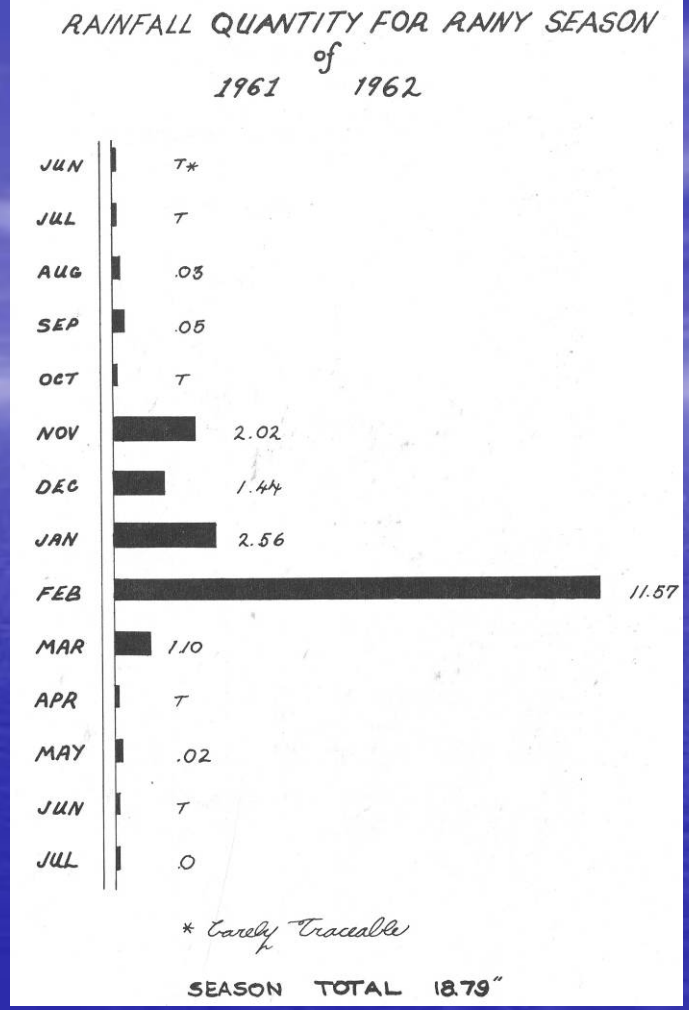
Decisions of the past year are being put into action, our membership is expanding and A.E.G. is moving ahead. Express your opinions on the current issues at your meetings so that those representing you will be informed. We need your active participation in A.E.G. -- but we also need your financial support. So send in your 1963 dues and your registration assessment and save the Treasurer the mailing of second notices.

Burt Marliave

AEG Newsletter

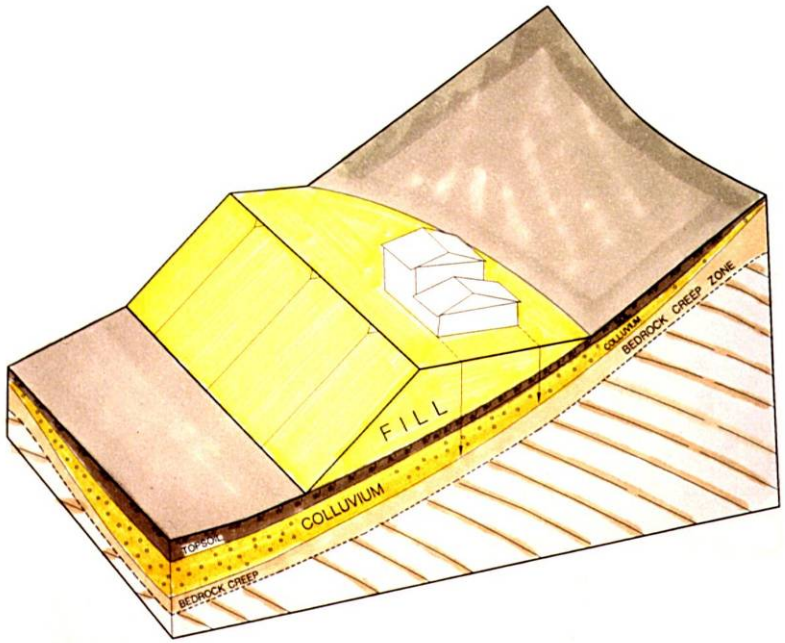
- This is the January 1963 AEG Newsletter informing the membership that the board had voted to drop the word “California” from their name and their support of a geology registration bill in the State Legislature

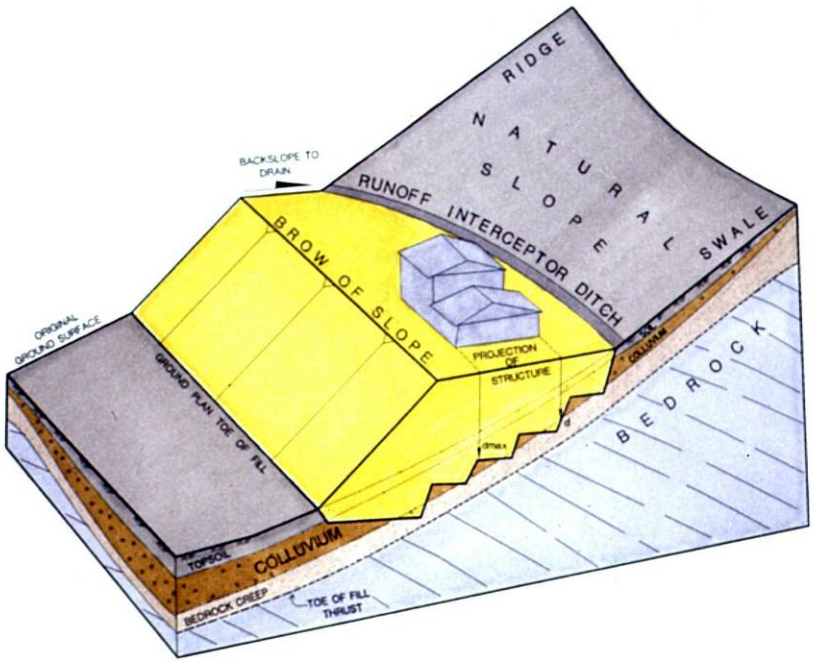

Figure 1-1.



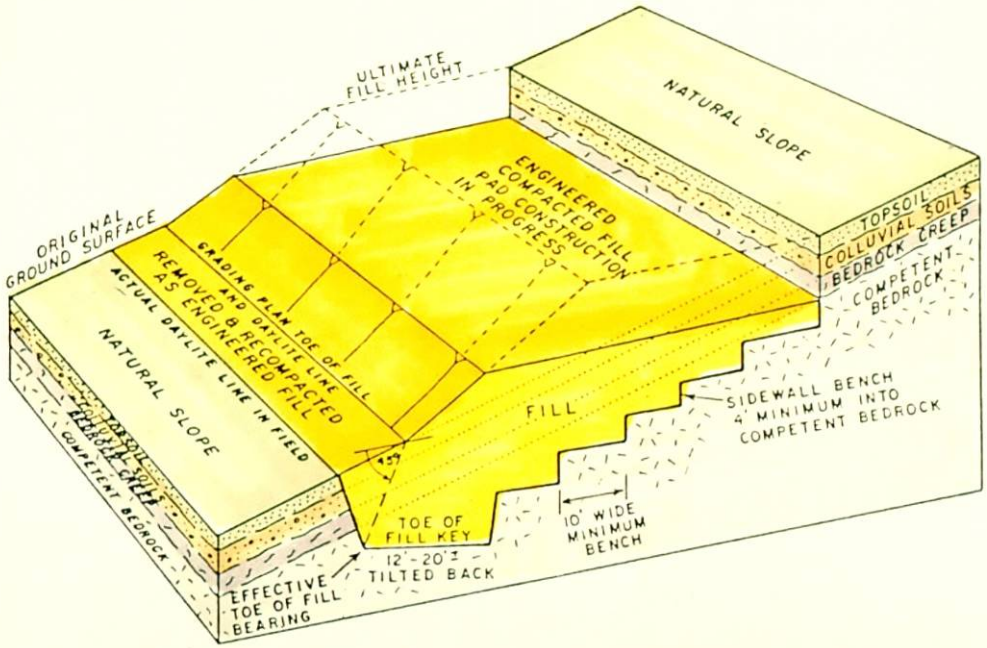
- **In February 1962 Los Angeles was struck by a series of destructive storms, and the stage was set for revising the City's original grading code, which had been the *nation's first grading ordinance* when adopted in 1952.**

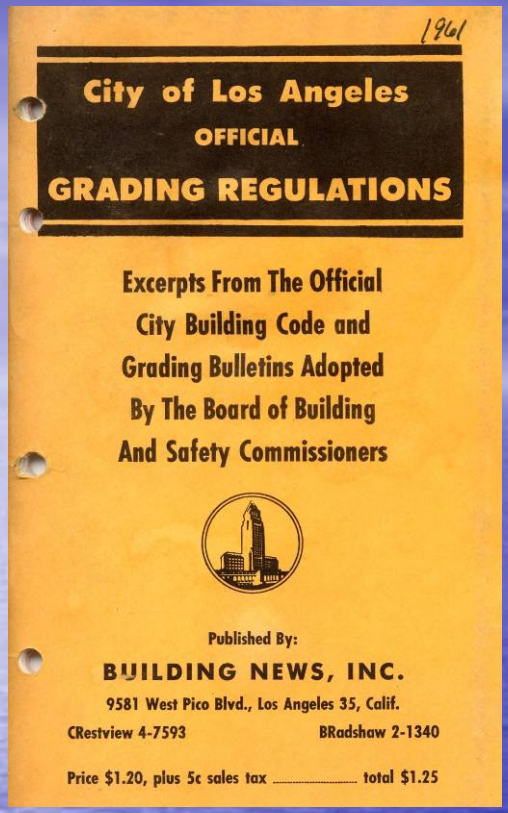
Evolution of Grading Codes

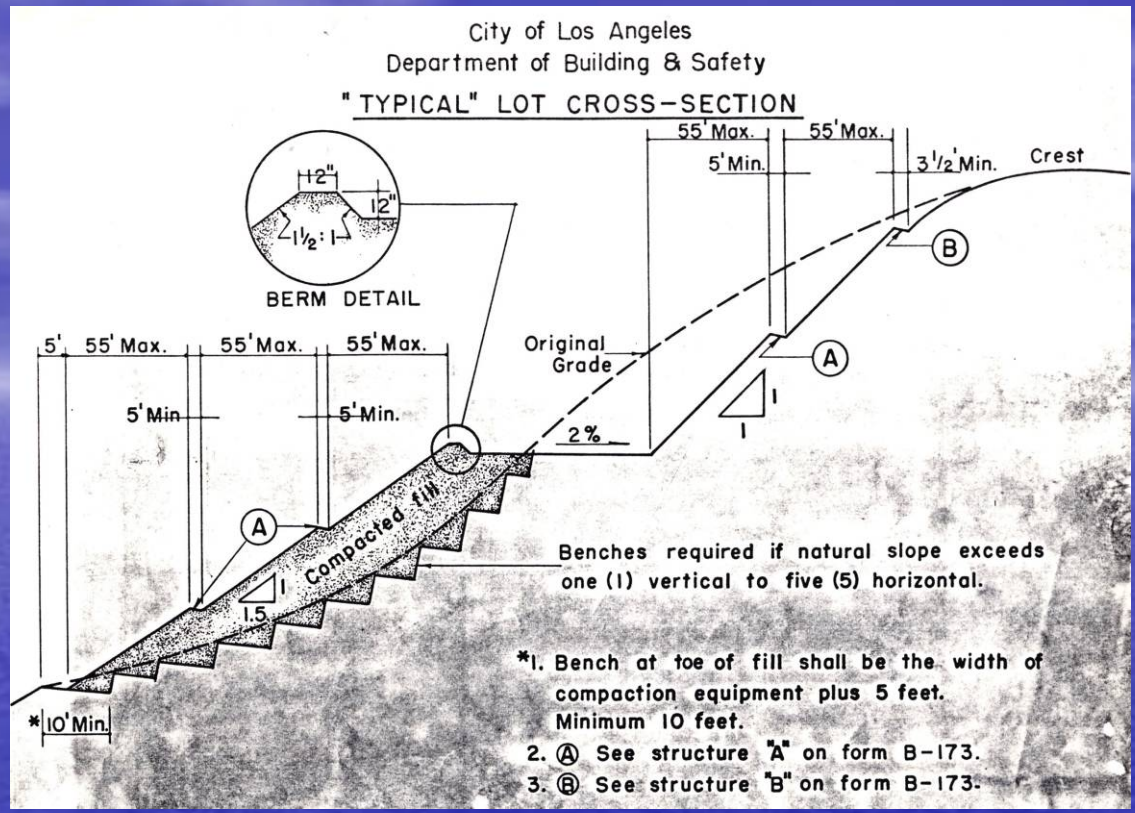




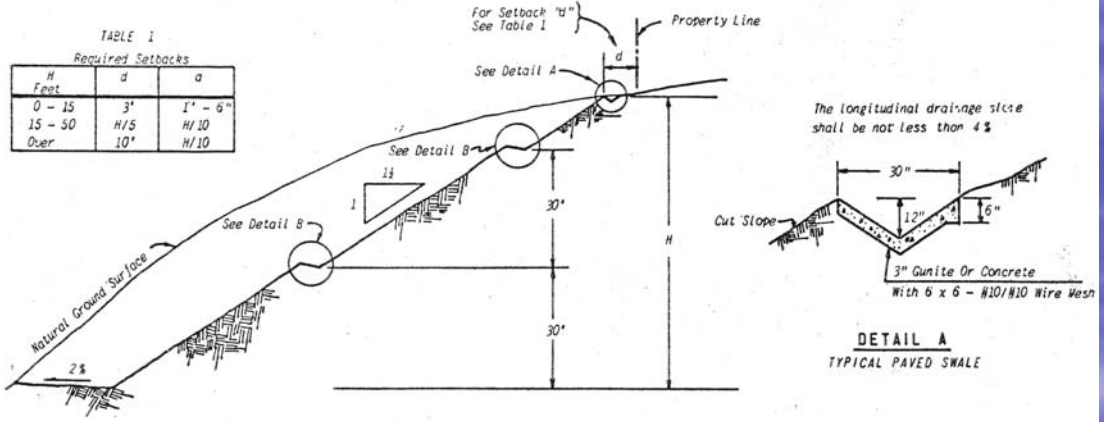
A typical toe-of-fill key for the construction of a sidehill fill in siltstone or shale terrain. The toe-of-fill key frequently requires keying and benching through several feet of topsoil, several feet of colluvium, and several feet of bedrock creep in order to key into competent bedrock. Toe-of-fill keys 10–20 ft. deep are common in such areas. Note that the effective bearing point of this toe of fill (45° from the horizontal) moves laterally downslope from the proposed grading plan toe.





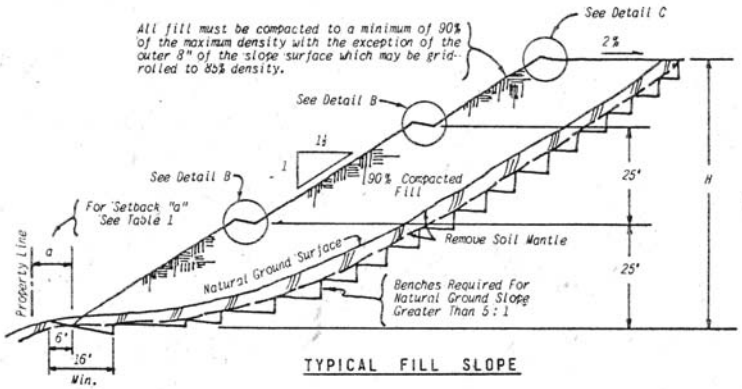


- In 1961, the City of Los Angeles established an **Engineering Geologists Qualifications Board** and a **Hillside Planning Committee** of the Department of Building & Safety.
- These committees, along with AEG's **Building Codes Committee**, developed the more comprehensive "modern grading code" after the 1962 storm season.

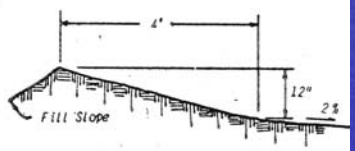


TYPICAL CUT SLOPE

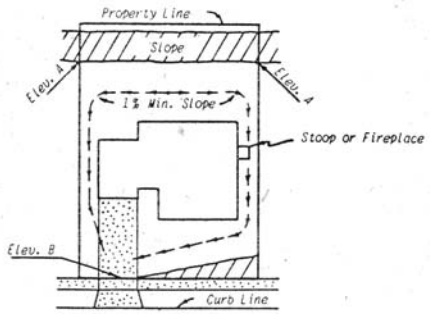
DETAIL A
TYPICAL PAVED SWALE



TYPICAL FILL SLOPE

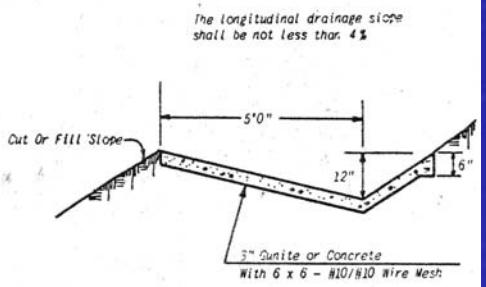


DETAIL C
Typical Berm At Top Of All Fill Slopes



TYPICAL FINISH GRADING

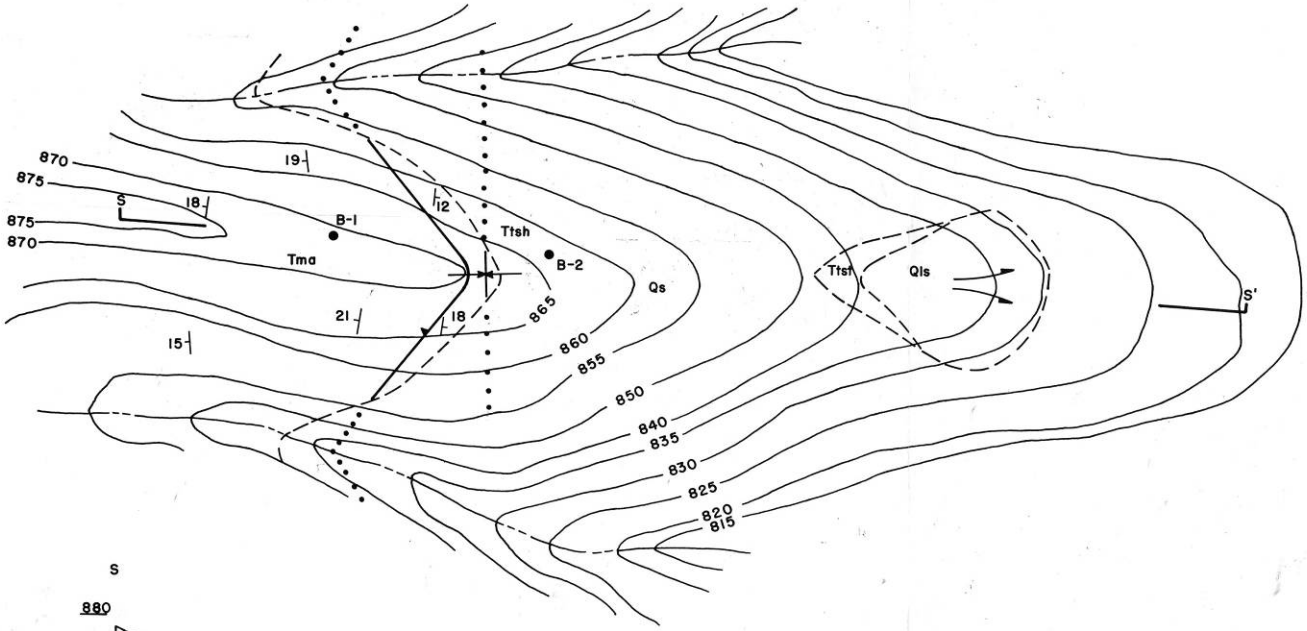
1. Elev. A to be rough graded at a slope of 2% higher than outlet Elev. B. Finish grading must provide positive drainage to street.
2. A paved swale, a catch basin and pipe, or other similar drainage device is required when a stoop, fireplace, or portion of the building extends within 5 feet of the property line.

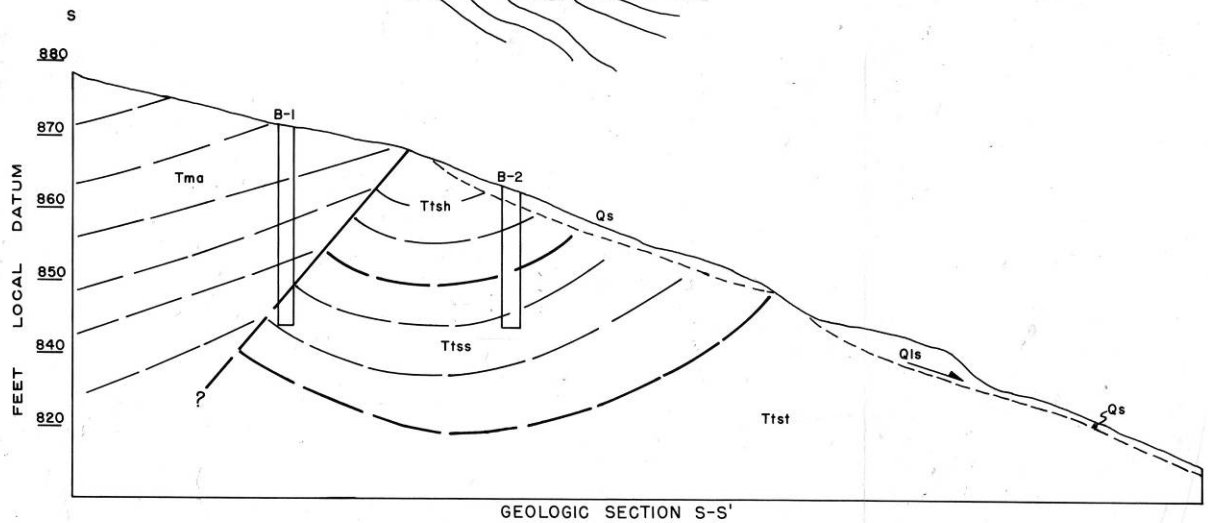


DETAIL B
TYPICAL TERRACE DRAIN

Standards

- The City of Los Angeles had a leading role in establishing standards for excavation, grading and site drainage that were usually adopted by neighboring agencies within a few years.

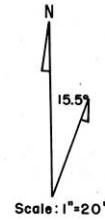




GEOLOGIC SECTION S-S'

EXPLANATION

Qs	SOIL
Qls	LANDSLIDE DEBRIS
Tt	TOPANGA FORMATION: sh–shale member; ss–sandstone member; si–siltstone
Tma	MARTINEZ FORMATION
	SURFICIAL DEPOSIT CONTACT
	FORMATION CONTACT
	FAULT CONTACT, DOTTED WHERE CONCEALED, SHOWING DIP
46	BEDDING ATTITUDE
	TRACE OF AXIAL PLANE OF SYNCLINE, DOTTED WHERE CONCEALED
B-2	TEST BORING LOCATION
S	GEOLOGIC SECTION LINE
	DIRECTION OF LANDSLIDE DEBRIS MOVEMENT
	STREAM CHANNEL

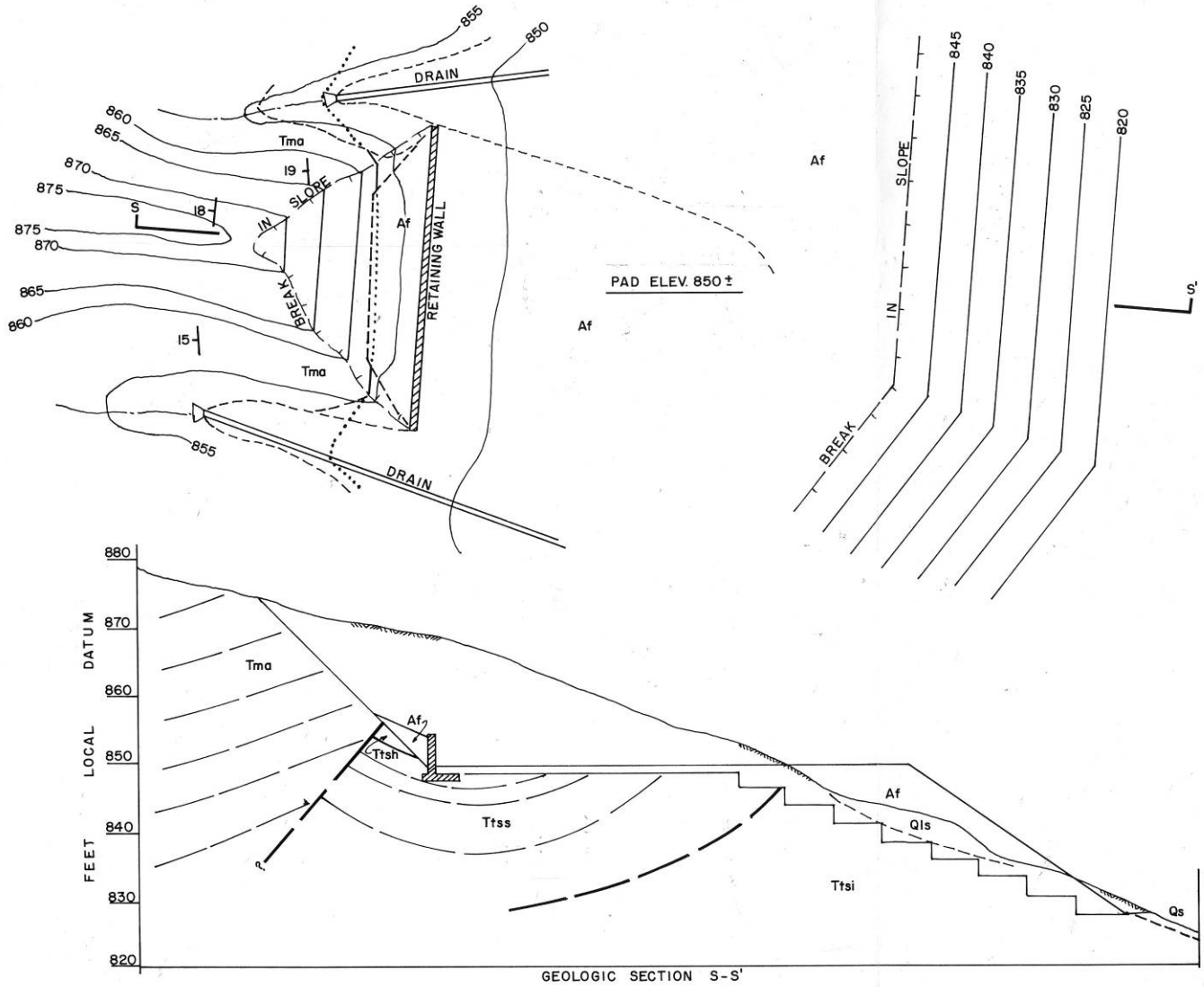


(IDENTIFYING DATA OMITTED)

ENGINEERING GEOLOGY MAP

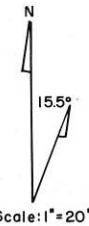
GEOLOGIC DATA OF SIGNIFICANCE TO THE ENGINEER IS SUPERIMPOSED ON THE TOPOGRAPHIC MAP. A GEOLOGIC SECTION IS ADDED TO FACILITATE ANALYSIS IN THREE DIMENSIONS. EXPLANATION OF SYMBOLS SHOULD ACCOMPANY THE MAP. DETAILED DESCRIPTIONS OF THE EARTH MATERIALS ARE USUALLY GIVEN IN THE TEXT OF THE REPORT.

- **1964 Engineering Geologic Map standards from City of Los Angeles**



EXPLANATION

Af	ARTIFICIAL FILL
Qs	SOIL
Qls	LANDSLIDE DEBRIS
Tt	TOPANGA FORMATION: sh-shale member; ss-sandstone member; si-siltstone
Tma	MARTINEZ FORMATION
	SURFICIAL DEPOSIT CONTACT
	FORMATION CONTACT
	FAULT CONTACT, DOTTED WHERE CONCEALED, SHOWING DIP
46	BEDDING ATTITUDE
	TRACE OF AXIAL PLANE OF SYNCLINE, DOTTED WHERE CONCEALED
S	GEOLOGIC SECTION LINE
	STREAM CHANNEL



Scale: 1"=20'

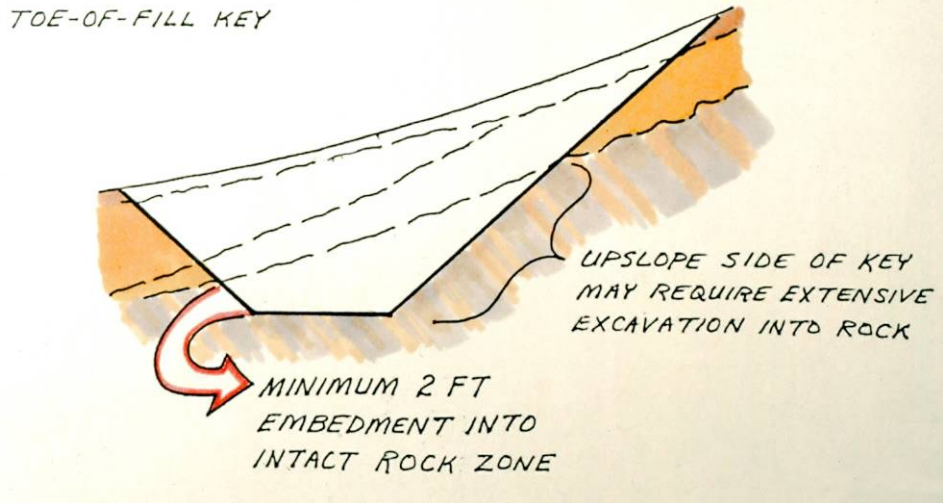
(IDENTIFYING DATA OMITTED)

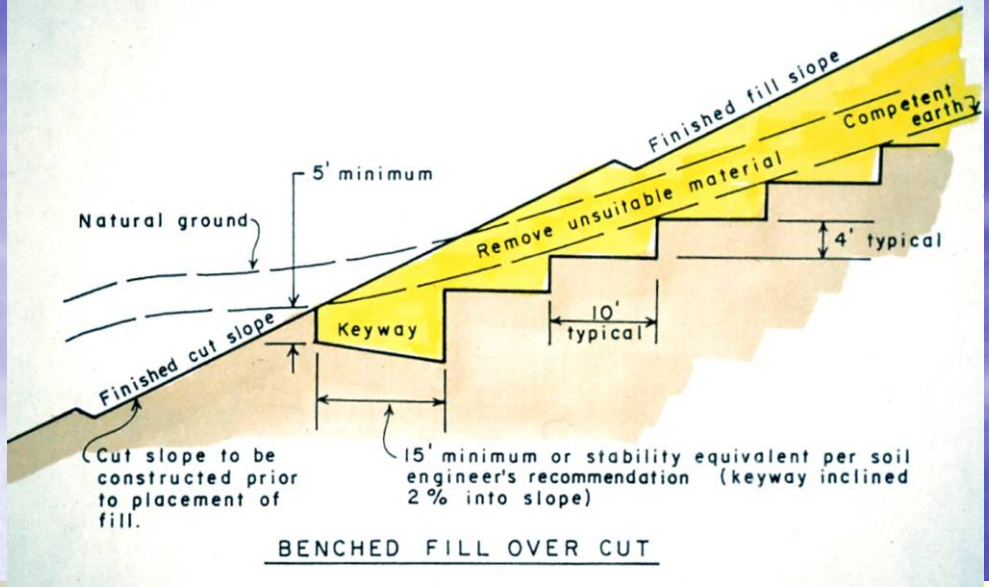
GEOLOGIC MAP AND GRADING PLAN

FREQUENTLY THE GEOLOGIC MAPS ACCOMPANIED BY A GRADING PLAN SHOWING ORIGINAL AND PROPOSED CONTOURS IS SUFFICIENT TO SHOW THE EFFECT OF GEOLOGIC FACTORS ON THE PROPOSED DEVELOPMENT. HOWEVER, IN MANY CASES IT MAY BE NECESSARY-FOR CLARITY AND EASE OF ANALYSIS – TO SHOW THE GEOLOGY ON THE GRADING PLAN. ADDITIONAL CLARITY WOULD RESULT FROM THE PRESENTATION OF SECTIONS. IF DESIGN DATA FROM ENGINEERS ARE AVAILABLE, SUCH FEATURES AS RETAINING WALLS AND BENCHES BENEATH FILLS MAY BE INCLUDED.

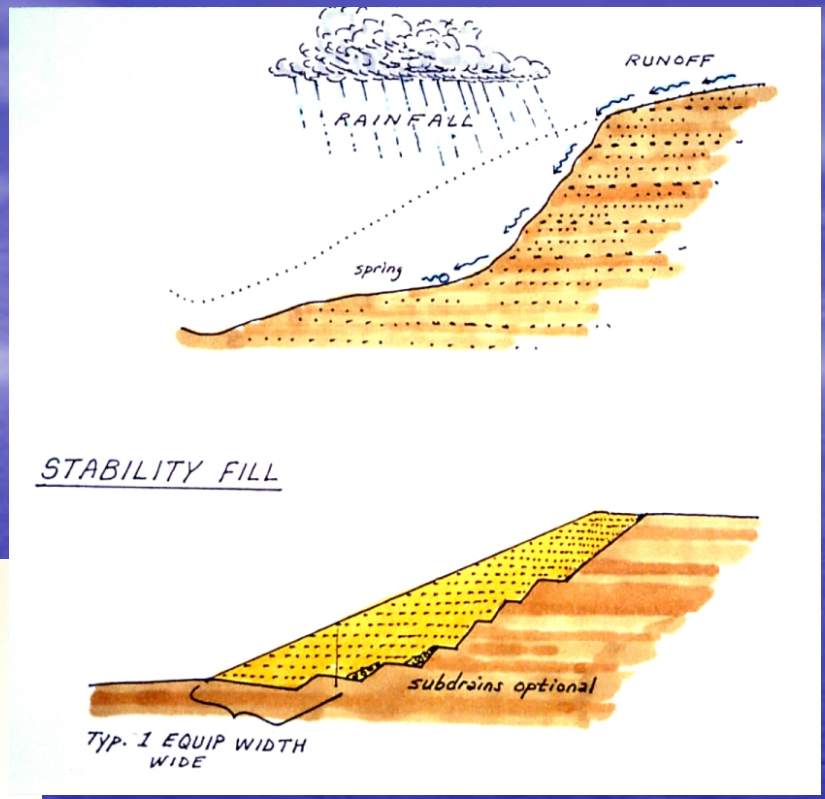
- 1964 **As-Built Geologic Map and Grading Plan** standards from the City of Los Angeles

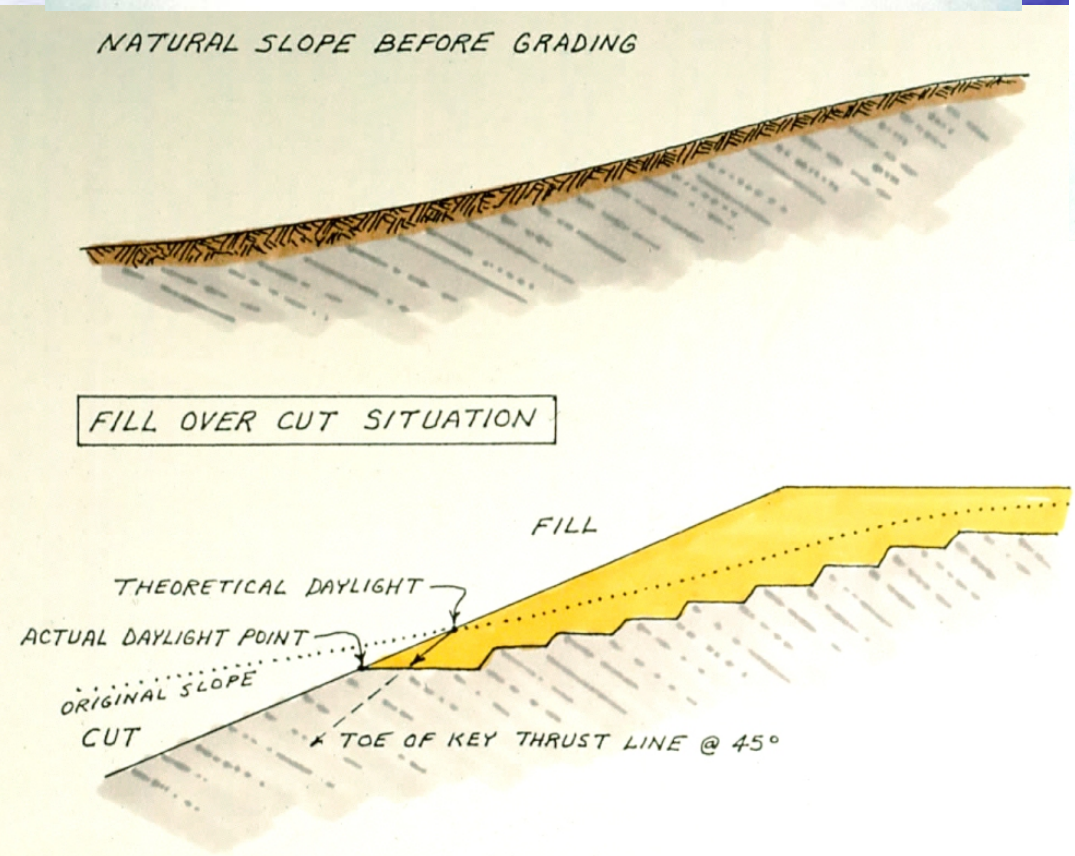
Keyway excavation standards



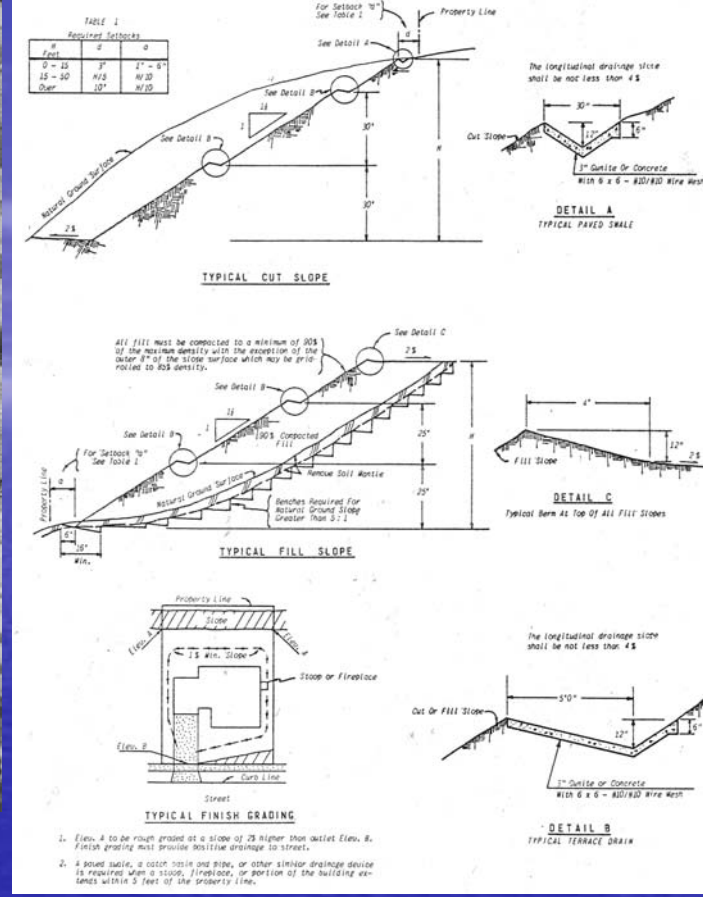


BENCHED FILL OVER CUT



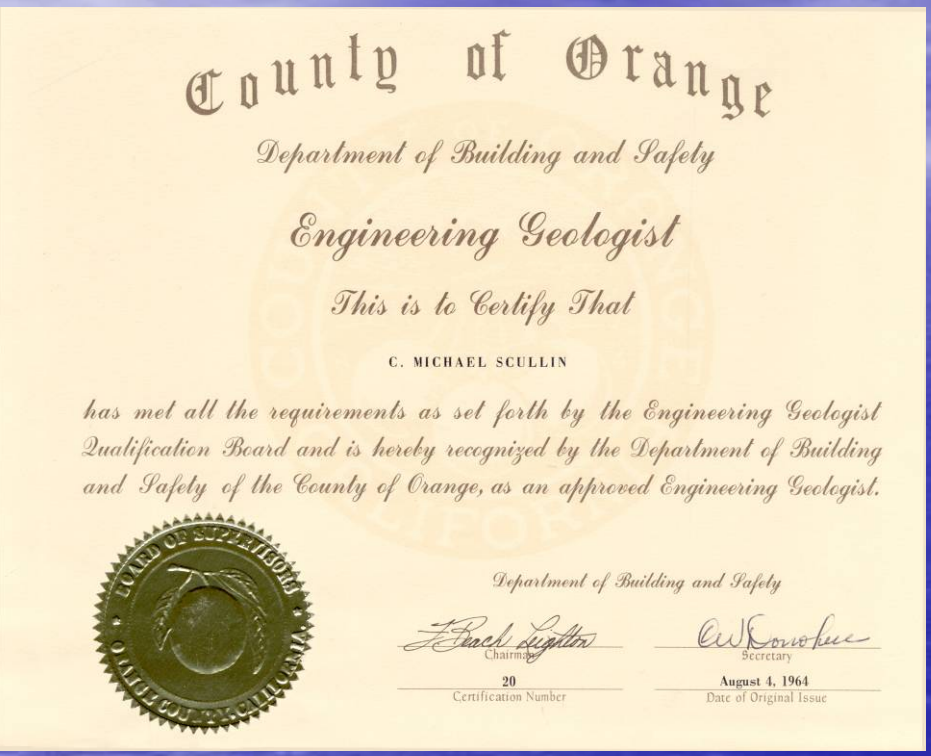


More examples of graphic standards for grading and excavation, from Mike Scullin's ICBO grading courses



- **The 1962 grading code required engineering geologic input, by geologists whose qualifications had been approved by special boards in Los Angeles City and County, as well as Ventura and Orange Counties.**

Certification of Engineering Geologists begins in 1962



County of Orange

Department of Building and Safety

Engineering Geologist

This is to Certify That

C. MICHAEL SCULLIN

has met all the requirements as set forth by the Engineering Geologist Qualification Board and is hereby recognized by the Department of Building and Safety of the County of Orange, as an approved Engineering Geologist.

BOARD OF SUPERVISORS · ORANGE COUNTY, CALIFORNIA

Department of Building and Safety

Chairman

Secretary

20
Certification Number

August 4, 1964
Date of Original Issue

City of Los Angeles

Board of Building and Safety Commissioners

Engineering Geologist

This is to Certify That

C. MICHAEL SCULLIN

HAS MET ALL THE REQUIREMENTS AS SET FORTH BY THE ENGINEERING GEOLOGIST QUALIFICATION BOARD, AND IS HEREBY RECOGNIZED BY THE BOARD OF BUILDING AND SAFETY COMMISSIONERS OF THE CITY OF LOS ANGELES, AS AN APPROVED ENGINEERING GEOLOGIST.

BOARD OF BUILDING AND SAFETY COMMISSIONERS

A. J. LUND, Secretary

January 10, 1963

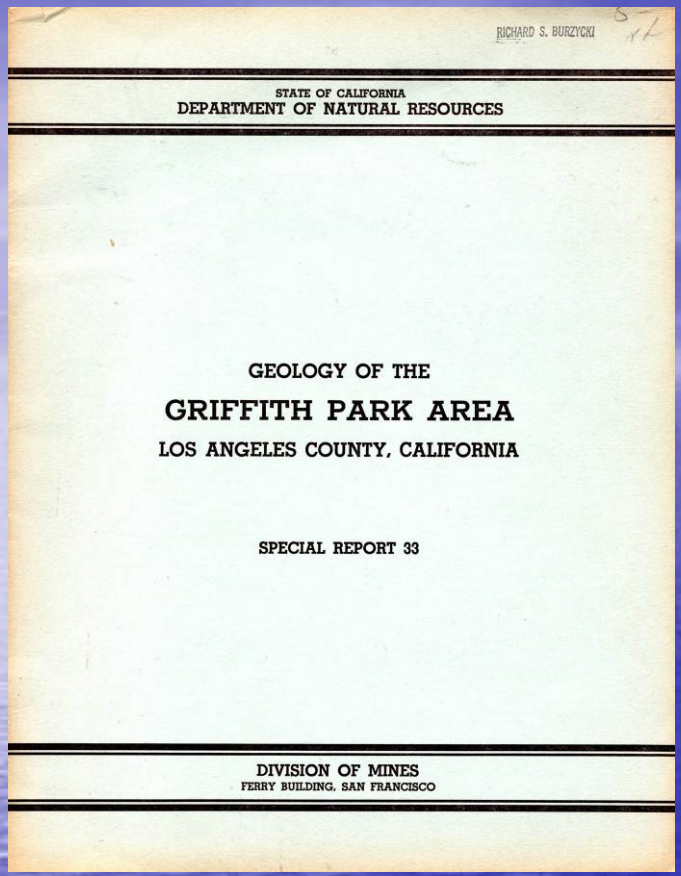
Date of Original Issue

CITY OF LOS ANGELES · FOUNDED 1781

CAEG formed a Building Codes Committee in 1959, which developed the modern grading code after the 1961-62 storm season. In 1962 the City of Los Angeles began certifying engineering geologists, followed soon thereafter, by the Counties of Los Angeles, Orange, and Ventura.

ENVIRONMENTAL ENGINEERING AEG GEOLOGISTS


HISTORY



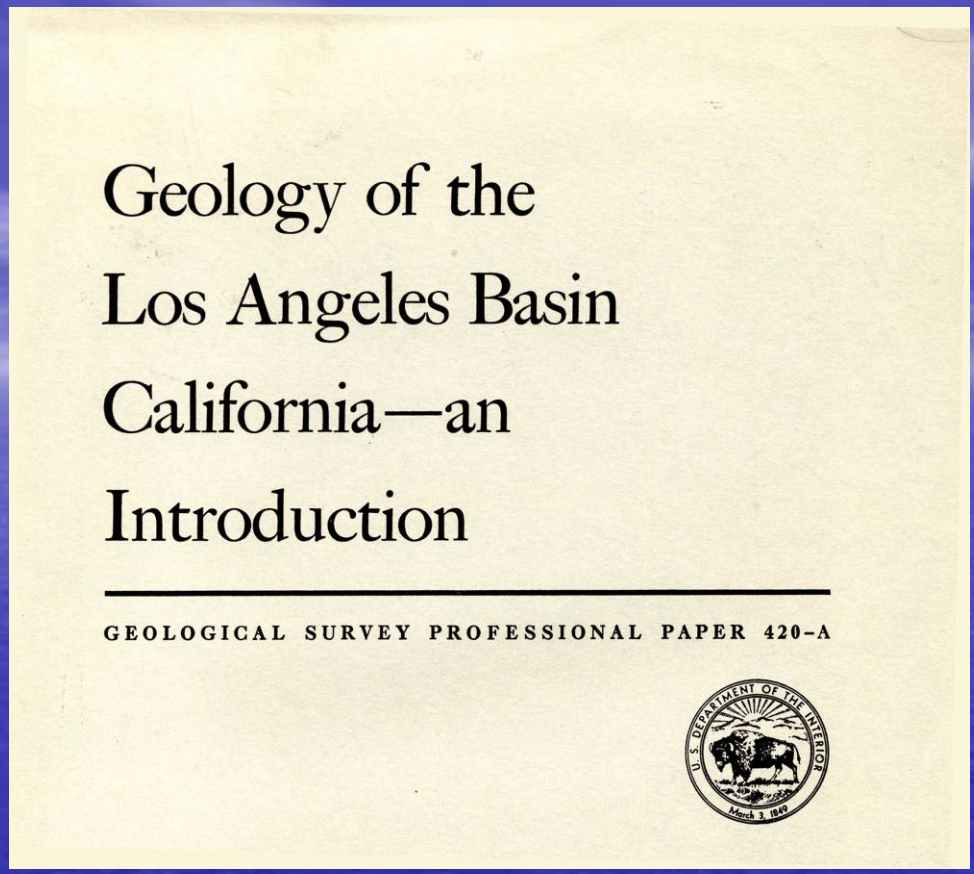
RICHARD S. BURZYCKI

STATE OF CALIFORNIA
DEPARTMENT OF NATURAL RESOURCES

GEOLOGY OF THE
GRIFFITH PARK AREA
LOS ANGELES COUNTY, CALIFORNIA

SPECIAL REPORT 33

DIVISION OF MINES
FERRY BUILDING, SAN FRANCISCO



Geology of the
Los Angeles Basin
California—an
Introduction

GEOLOGICAL SURVEY PROFESSIONAL PAPER 420-A

U.S. DEPARTMENT OF THE INTERIOR
March 3, 1849

The City and County of Los Angeles contacted with the USGS and the CDMG to map hillside areas in portions of the San Gabriel and Santa Monica Mtns, as well as all of the Palos Verdes Peninsula. These played an enormous role in the evolution of grading codes and standard-of-practice in south coastal California.

ENVIRONMENTAL ENGINEERING
AEG
GEOLOGISTS

Orange County contracted with the CA Division of Mines & geology for similar geohazard studies, which began appearing in the early 1970s

GEOLOGY AND ENGINEERING GEOLOGIC ASPECTS OF THE SOUTH HALF OF THE CAÑADA GOBERNADORA QUADRANGLE, ORANGE COUNTY, CALIFORNIA

1974

CALIFORNIA DIVISION OF MINES AND GEOLOGY

PREPARED IN COOPERATION WITH THE COUNTY OF ORANGE DEPARTMENT OF BUILDING AND SAFETY, ROAD DEPARTMENT AND THE ORANGE COUNTY FLOOD CONTROL DISTRICT.

SPECIAL REPORT 111

GEOLOGY OF THE SOUTH HALF OF THE EL TORO QUADRANGLE, ORANGE COUNTY, CALIFORNIA

1974

CALIFORNIA DIVISION OF MINES AND GEOLOGY

PREPARED IN COOPERATION WITH THE COUNTY OF ORANGE DEPARTMENT OF BUILDING AND SAFETY, ROAD DEPARTMENT AND THE ORANGE COUNTY FLOOD CONTROL DISTRICT.

SPECIAL REPORT 110

J. David Rogers

GEO-ENVIRONMENTAL MAPS OF ORANGE COUNTY, CALIFORNIA

1973

Preliminary Report 15

THE CALIFORNIA DIVISION OF MINES AND GEOLOGY

- Aerial oblique comparisons of the Porter Ranch area north of the San Fernando Valley in 1962 (at left) and after mass grading for development, in 1979 (at right). Over 100 million cubic yards of material was moved each year in Los Angeles County.

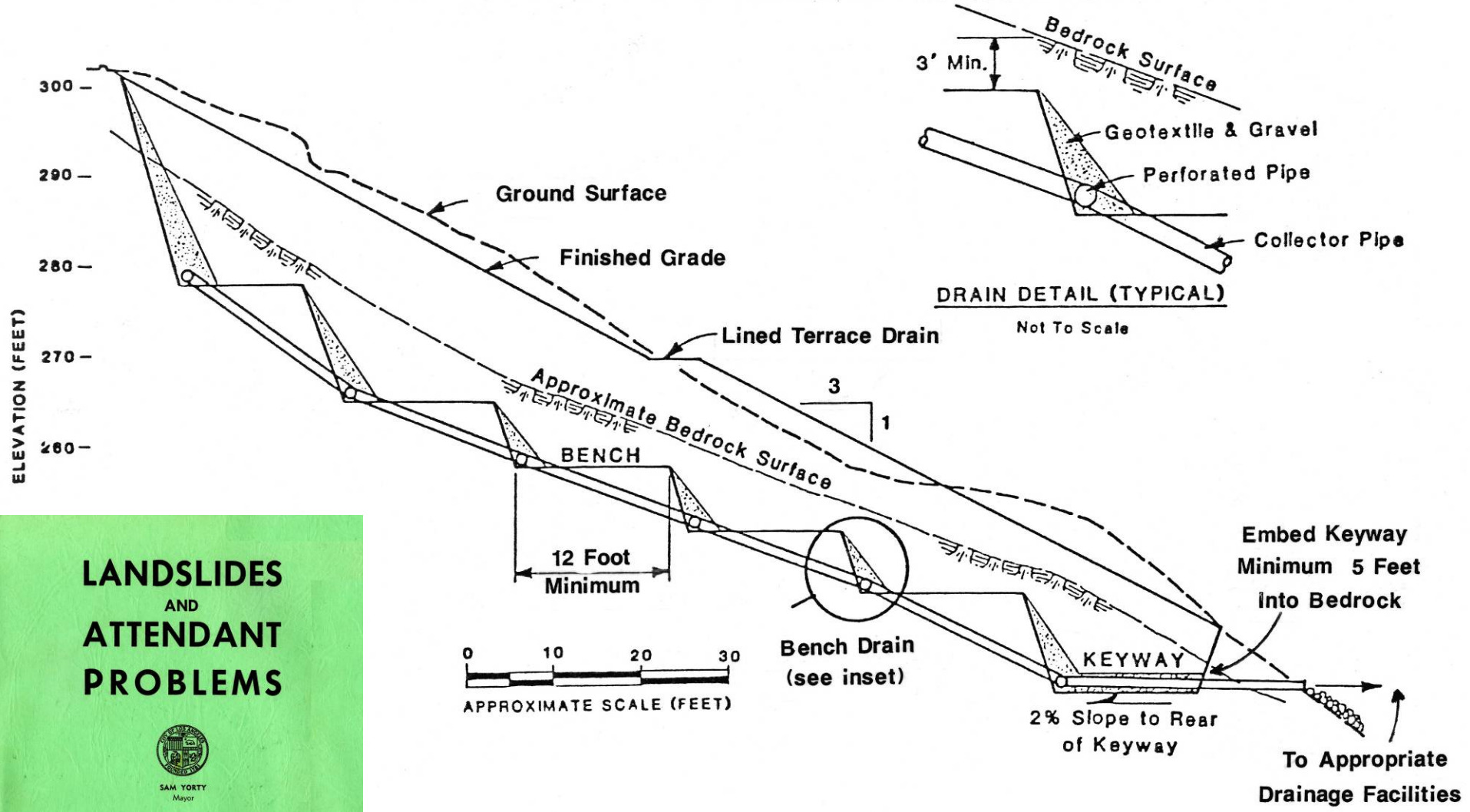
Figure 1-4.

Figure 1-5.

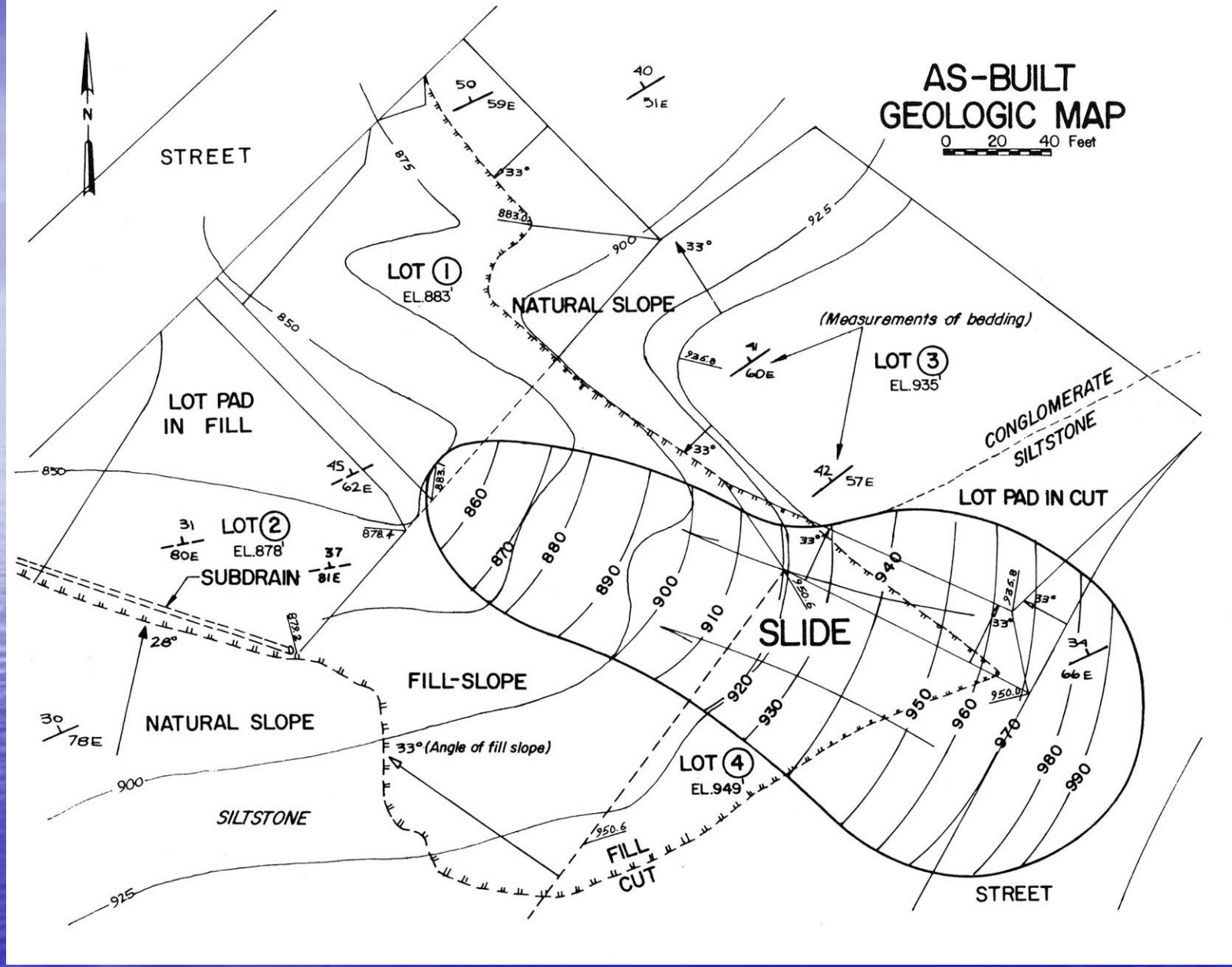
- **Deep Canyon** in the Santa Monica Mountains before mass grading in 1971 (at left), and after grading, in 1979 (at right).
- Mass grading allowed densely populated subdivisions to be safely constructed in deeply dissected uplands, prone to natural landslippage.

Around 1960 several southland geologists began using large diameter bucket auger excavations to assess complex geologic conditions. This became the preferred method of site exploration over the following decade.

TYPICAL LANDSLIDE REPAIR SECTION



- **In 1967 Los Angeles also developed standards for landslide repairs using mass grading.**



- **Many southland consultants evolved even higher standards for their work on landslides.**

Bolsa Nuclear Power & Desal Plant

- One of the most challenging projects of the 1960s was MWD's proposed Bolsa nuclear power and desalination plant, which would have been situated offshore

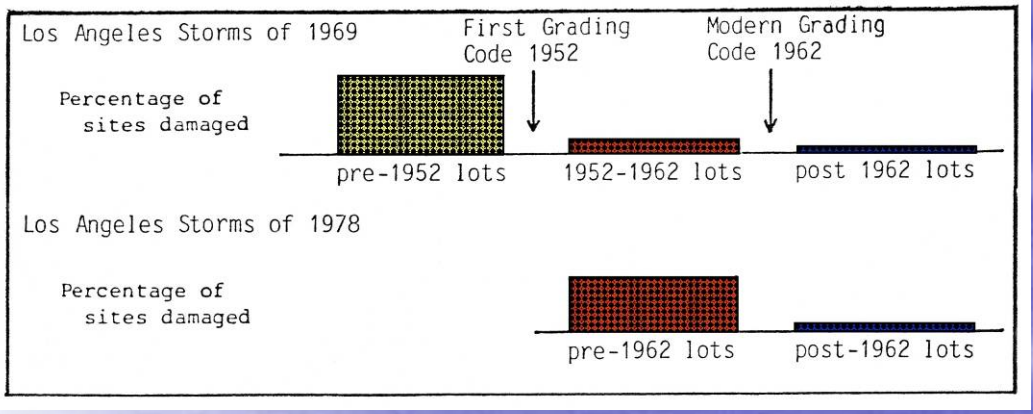
1969 storms

7. GLENCOE HEIGHTS January 27, 1969

Photograph showing home destroyed by debris and mudflows in the Glencoe Heights area near Glendora.

More storms bring more sobering lessons ....

- January 1969 saw a 100-y recurrence frequency storm sequence in southern California, followed by a 75 year frequency event in February. If LACFCD hadn't mucked many of their smaller basins during the brief interval, catastrophe might have ensued...



Damage Associated with Destructive Storms of 1969 in Hillside Areas of Los Angeles

	Sites developed prior to 1952	Sites developed 1952-1962	Sites developed 1963-1969
Number of sites constructed	10,000	27,000	11,000
Total damage	$3,300,000	$2,767,000	$184,400
Average damage per site	$300	$100	$17
Percentage of sites damaged	10.4%	1.3%	0.15%

SOURCE: Slosson, 1969

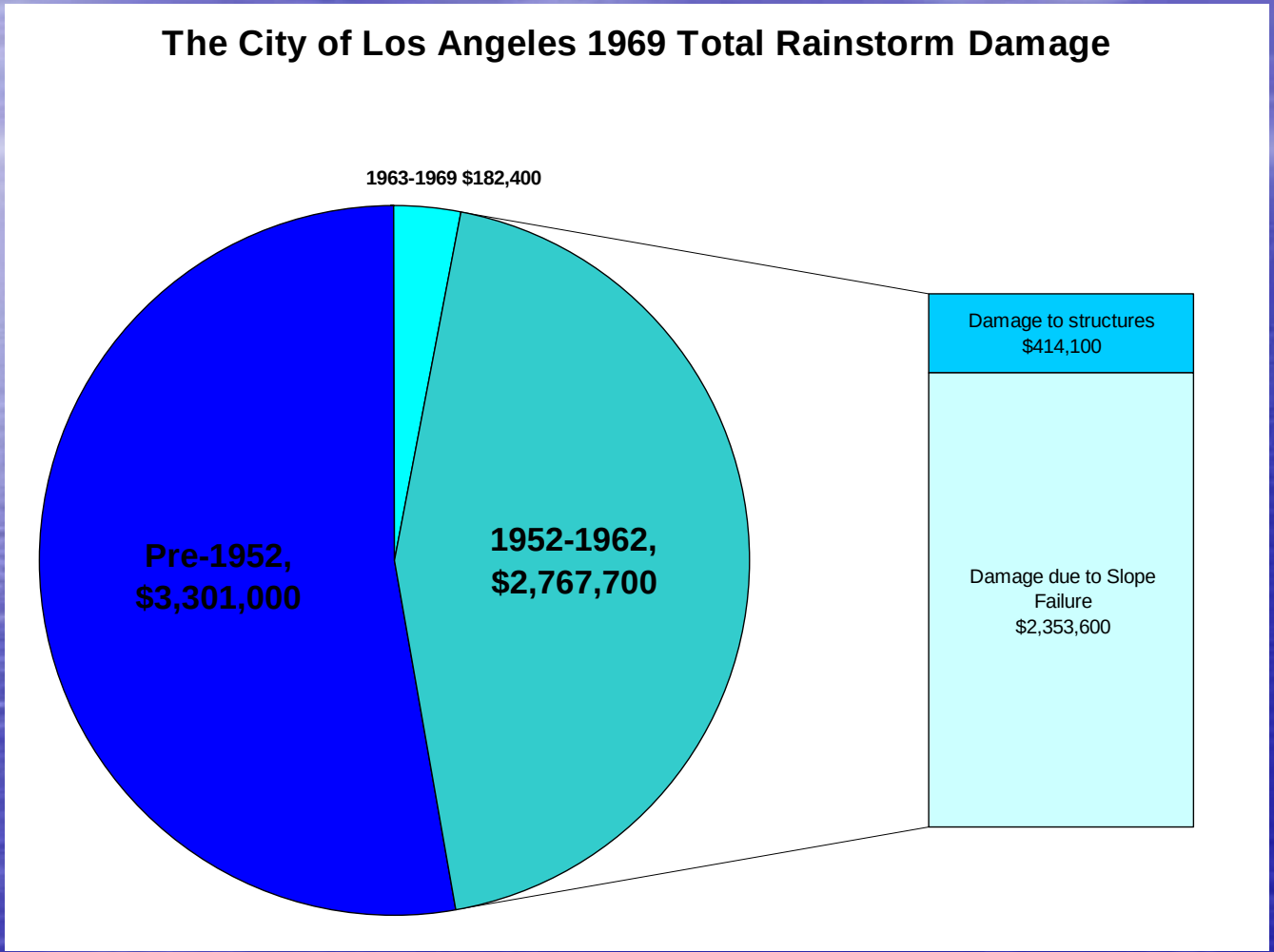
Slope Failures in City of Los Angeles, 1978

	Sites developed prior to 1963	Sites developed after 1963
Number of sites constructed	37,000	30,000
Number of failures	2,790	210
Percentage of sites damaged	7.5%	0.7%

SOURCE: Slosson and Krohn, 1979

- In 1969, Jim Slosson began tabulating the property damage caused by the storms of 1962, 1969, and 1978 with which grading ordinance was in effect when they were permitted.
- These reports became the seminal documents justifying grading ordinances

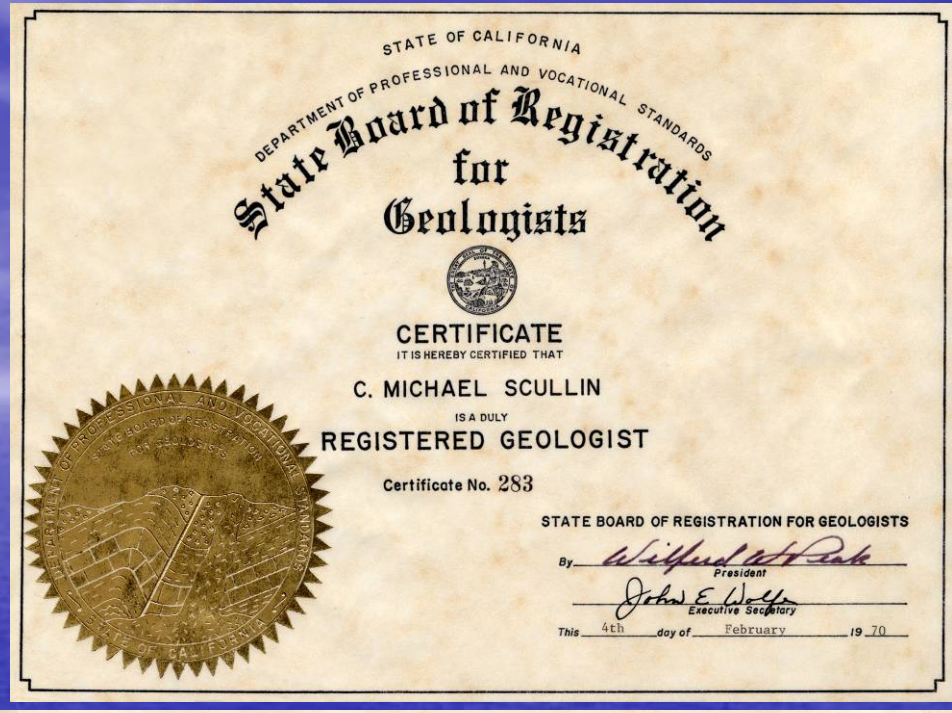
City of Los Angeles total property damage caused by storms of Jan-Feb 1969



- 55% of damage occurred on pre-1952 structures, 40% on those built between 1952-62; prior to adoption of modern grading codes.

Geology Registration at last !

- The California Board of Registration for Geologists and Geophysicists was finally established by statute in 1969, after 9 years of lobbying.
- Engineering geology specialty followed in 1970; geophysics in 1972; and hydrogeology in 1994.

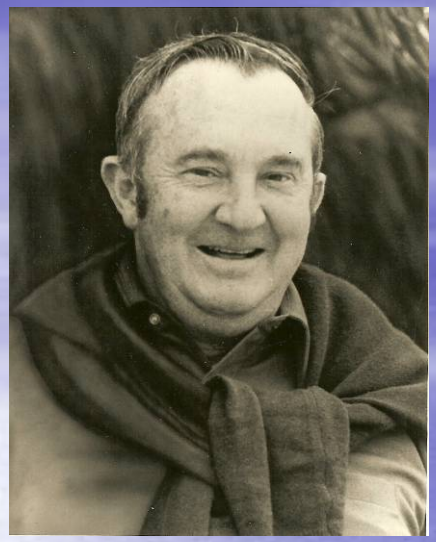

STATE OF CALIFORNIA
DEPARTMENT OF PROFESSIONAL AND VOCATIONAL STANDARDS
State Board of Registration for Geologists
CERTIFICATE
IT IS HEREBY CERTIFIED THAT
C. MICHAEL SCULLIN
IS A DULY
REGISTERED GEOLOGIST
Certificate No. 283
STATE BOARD OF REGISTRATION FOR GEOLOGISTS
By Wilfred A. Peake
President
John E. Wolfe
Executive Secretary
This 4th day of February 19 70


STATE OF CALIFORNIA
DEPARTMENT OF PROFESSIONAL AND VOCATIONAL STANDARDS
State Board of Registration for Geologists
THIS CERTIFICATE TESTIFIES THAT
C. MICHAEL SCULLIN
IS A DULY CERTIFIED
ENGINEERING GEOLOGIST
Certificate No. EG 170
STATE BOARD OF REGISTRATION FOR GEOLOGISTS
By Wilfred A. Peake
President
John E. Wolfe
Executive Secretary
This 25th day of November 1970

Earthquake of February 9, 1971

- The **Lower Van Norman Dam** experienced a liquefaction-induced failure of its upstream face
- It came perilously close to a catastrophe which could have easily killed 40,000 people in the San Fernando Valley.

Establishing master's degree programs in engineering geology



Dick Stone

Perry Ehlig

- In 1968 USC became the first school in California to offer a master's degree in engineering geology, pioneered by Jim Slosson and Dick Stone (left above).
- In 1978, Cal State Los Angeles also began offering a master's degree in engineering geology, championed by Marty Stout and Perry Ehlig (right above).

CANADA Tonight

TOP STORY

(LOS ANGELES QUAKE)

- 6.6 On Richter Scale
- Felt From S. Diego To L. Vegas
- Damaged Freeways, Burst Gas & Water Lines, Collapsed Buildings