Southern Pacific Transportation Company

welcomes the

AMERICAN RAILWAY ENGINEERING ASSOCIATION

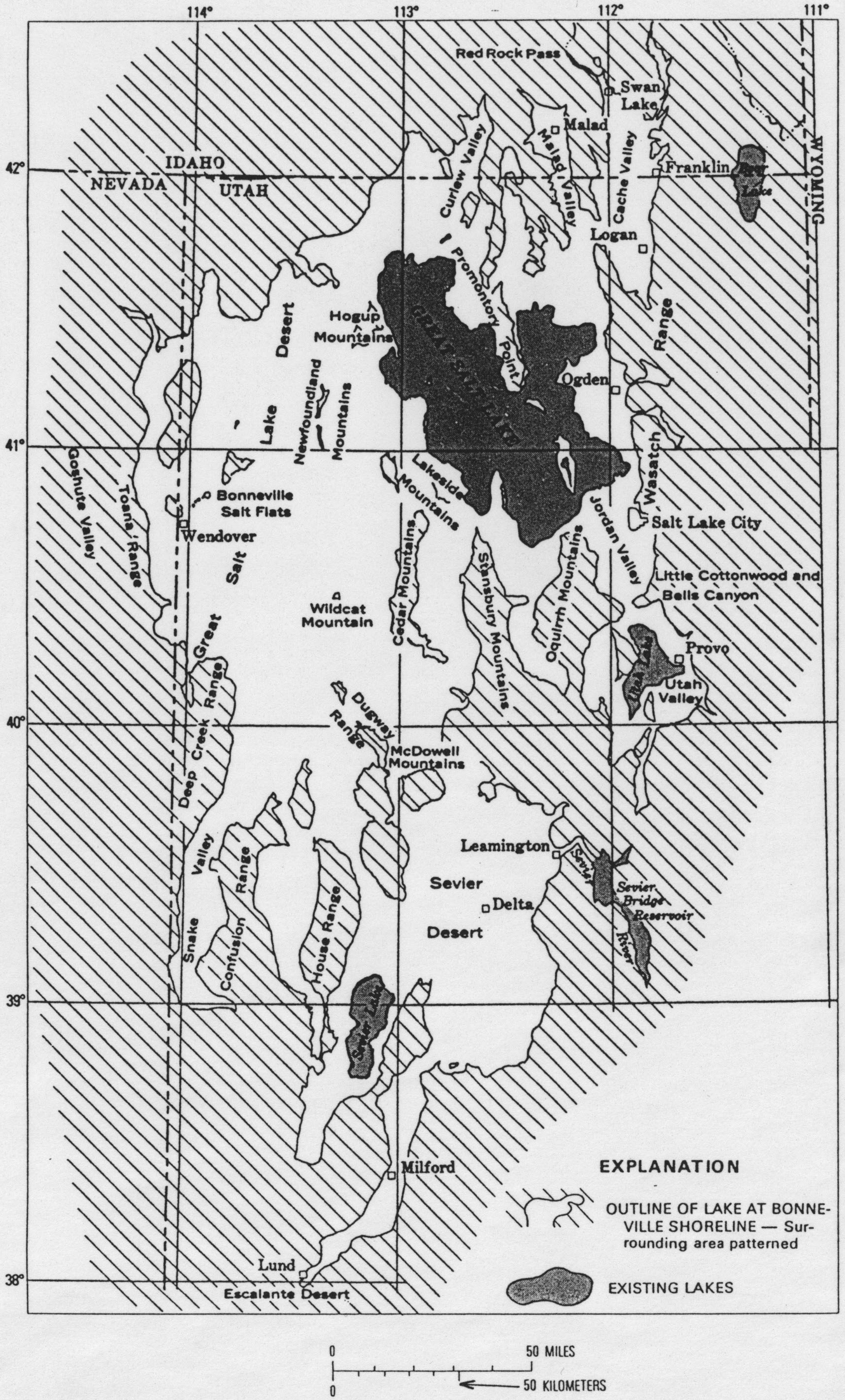
to the

GREAT SALT LAKE

OCTOBER 9, 1987

SP Southern Pacific Transportation Company Engineering - CADD Bureau

EN.C.GSL.AREA-SIGN



GEOGRAPHIC SETTING

The Great Salt Lake lies within the physical region of the Western United States known as the Great Basin. The lake itself is in one of the lowest parts of this basin, approximately 4200 feet above sea level. Because the Great Salt Lake is in such a low area within the basin, it is a terminal lake - it has no outlet to the sea. Currently, the lake is approximately 40 miles wide and 80 miles long, with an average depth of 22 feet and a maximum depth of 44 feet.

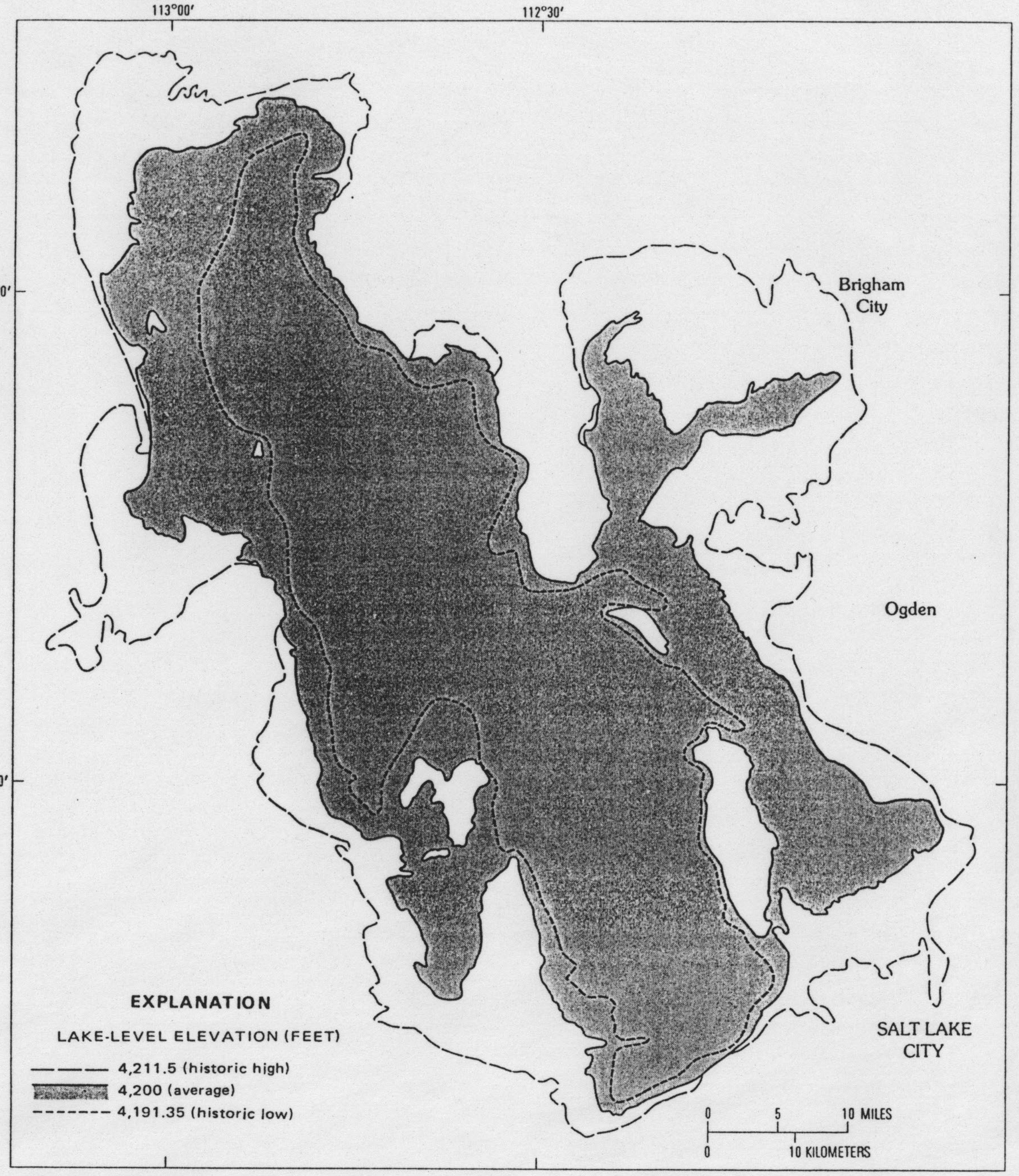
East of the lake lies the Wasatch Range, an imposing mountain chain which reaches 11,000 feet. These mountains contribute significantly to the inflow of the Great Salt Lake. West of the lake is the Great Salt Lake Desert, a flat expanse that is barren of all vegetation. The Bonneville Salt Flats are located within this desert and have been used for numerous attempts at the land-speed record.

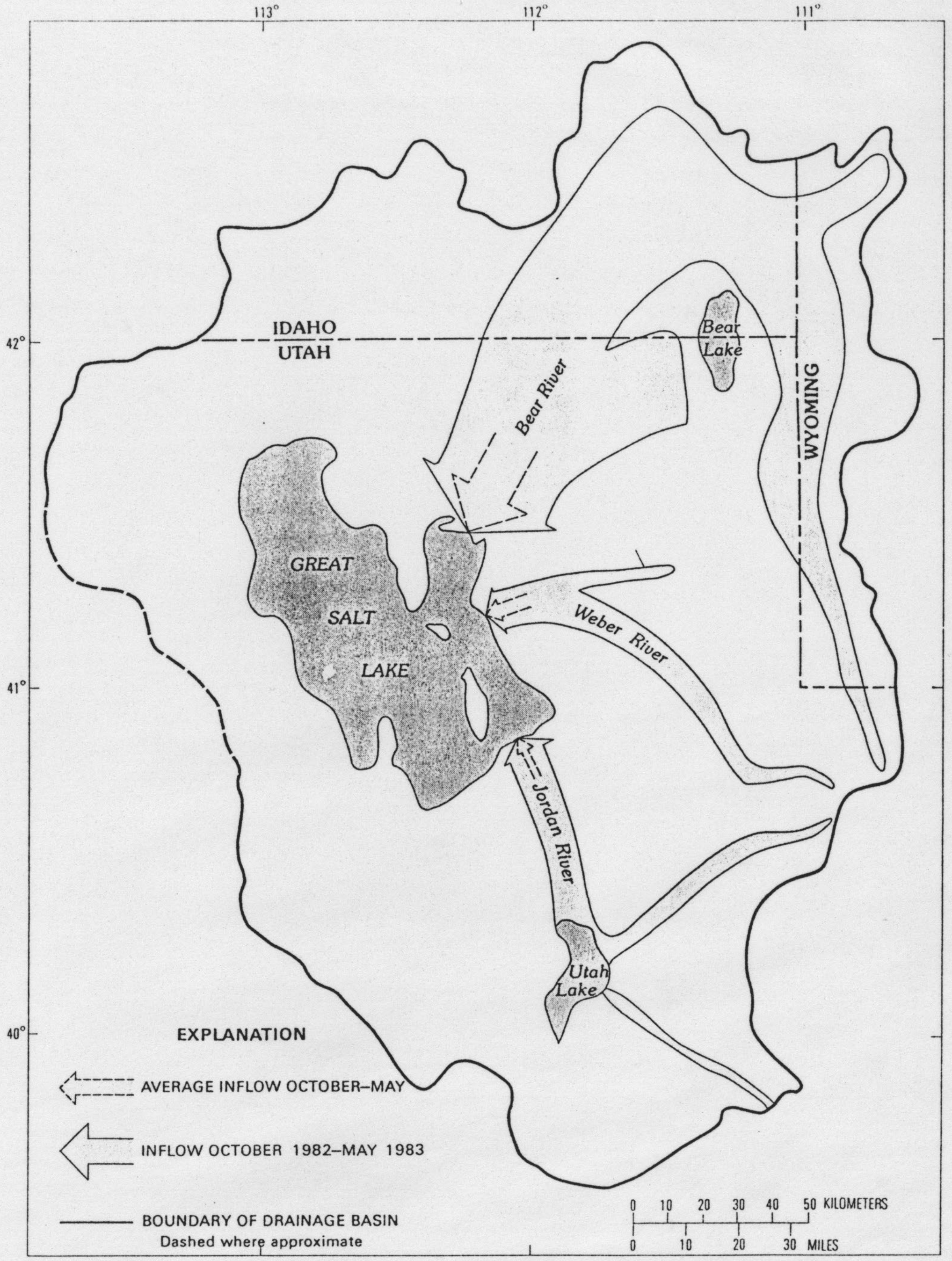
PREHISTORIC RECORD

The Great Salt Lake is a small remnant of Lake Bonneville, which covered about 20,000 square miles in Utah, Nevada and Idaho during the most recent ice age of the Pleistocence Epoch (See fig.). Lake Bonneville began to form some time prior to 26,000 years ago. It reached a peak of about 1,000 feet above the current level of the Great Salt Lake about 16,000 to 17,000 years ago, and it had declined to the approximate level of the existing lake about 11,000 years ago.

The mountains that surround the lake still display the shoreline markings or terraces of Lake Bonneville.During the glacial period,the elevation of Lake Bonneville reached a high enough elevation that it overflowed into the Snake River though Red Rock pass, (90 miles north of Ogden).As soon as the overflow started, a channel was formed that become deeper and deeper as the volume of water increase.The deeping of the channel was finally checked when it reached a sill of solid rock. The lake had rapidly dropped nearly 345 feet till it stabilized for several hundred years and created the Provo Terrace, which is about 625 feet above the existing lake elevation. Due to climatic changes the lake continued to drop, creating beaches whenever it stabilize for long periods of time.

The lake seems to have been below 4200 feet msl several times but was never completely dry. During the last 8,000 years, except for two rises above 4230 feet, the lake has remained near its historic average elevation of about 4,200 feet.





HISTORIC RECORD

When the Mormon pioneers arrived in Utah in 1847, the surface of the Great Salt Lake was about 4200 feet above sea level. Since that period the lake has fluctuated between a high of 4215.0 +/- in 1873 to a low of 4194.75 in 1963. At the high elevation, the lake covers about 2400 square miles. The average elevation for the last 140 years has been about 4203. Most of the industries, roads, railroads, and recreational facilities were built on the shoreline or through the lake in the period from 1900 to 1905 and from 1930 to 1982, when the lake was below 4203.

SALT CONTENT OF THE LAKE

The Great Salt Lake is one of the saltiest bodies of water in the world. Only the Dead Sea is saltier. The percentage of salt in the waters of the Great Salt Lake varies depending on the lake. At low levels the percentage of salt is as high as 27 percent, which is eight times saltier than sea water. At the current high lake levels, the percentage of salt north of the causeway is twenty percent and south of the causeway is ten percent. The unit weight of the salty water varies from 68 to 76 pounds per cubic foot.

DRAINAGE BASIN AND LAKE EFFECT

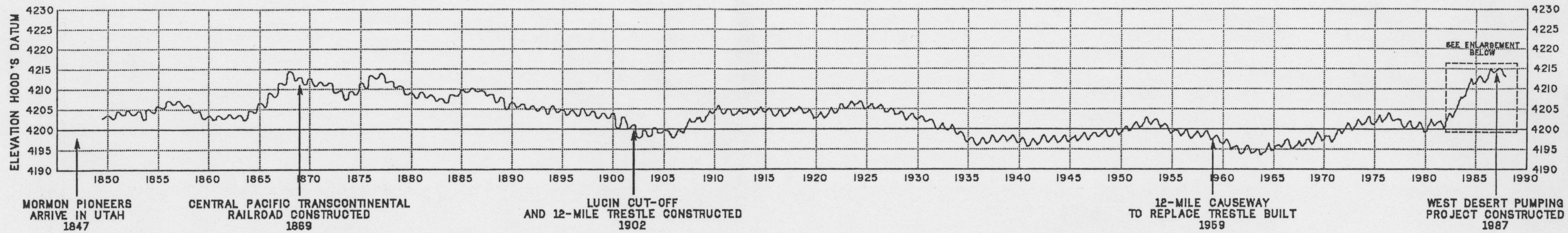
The current drainage basin for the lake is about 21,000 square miles Streams and rivers contribute about 66 percent of the average annual inflow, precipitation about 31 percent, and groundwater about 3 percent Total annual inflow averages about 3.0 million acre feet. Average evaporation is about 3.0 million acre feet so the lake elevation tends to remain constant. Inflows to the Great Sale Lake in water years 1982, 1983, 1984 & 1985 were respectivly 4.3, 7.5, 9.1 and 6.2 million acre feet.

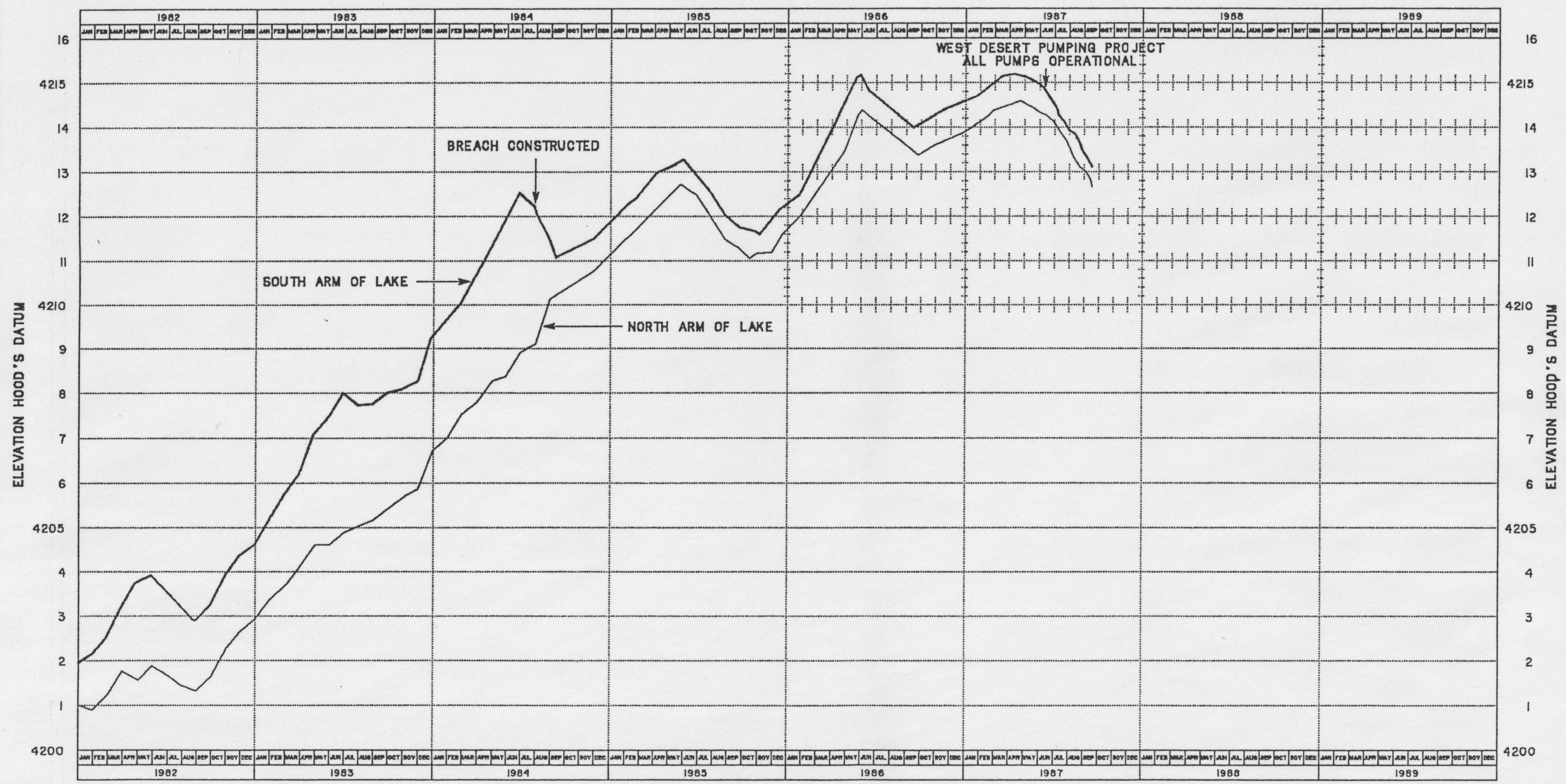
The surface water temperature of the Great Sale Lake varies from the upper 20's degrees F. in January to about 80 degrees F. in August. The lake does not freeze due to high salt content. During the winter and spring relatively worm moist air from the lake rises into colder stormy air and produces the heavy snowfall downwind in the Wasatch range.

CHANGES IN LAKE LEVEL

The surface level and surface area of the lake fluctuates continuously, primarily in response to climatic factors. Diversion of water for irrigation, industrial, commercial and residential use also affects the lake level but to a lesser extent than climate.

The lake has a yearly cycle (see figure next sheet). It begins to decline in spring or summer when the weather is hot enough so that the loss from the lake surface is greater than the inflow from surface streams, ground water and precipitation. It begins to rise in the autumn when the temperature decreases and the loss of water by evaporation is exceeded by the inflow.





LAKE ELEVATION		
DATE	SOUTH	NORTH
THIS WEEK - 9/24/87	4213.09	4212.55
LAST WEEK - 9/17/87	4213.15	4212.73
PEAK - 4/30/87	4215.16	4214.55

Mr. D. K. McNear
San Francisco
cc.W. J. Lacy
H. D. Fisher
L. G. Simpson
G. L. Murdock
E. P. Reilly
J. K. Young
R. E. Cox
D. J. Maxey
E. L. Hord
P. L. Hatch

Sacramento
cc.J. W. Lynch
J. J. Dele

Ogden
cc.R. L. Burton

SP Southern Pacific Transportation Company Engineering - CADD Bureau

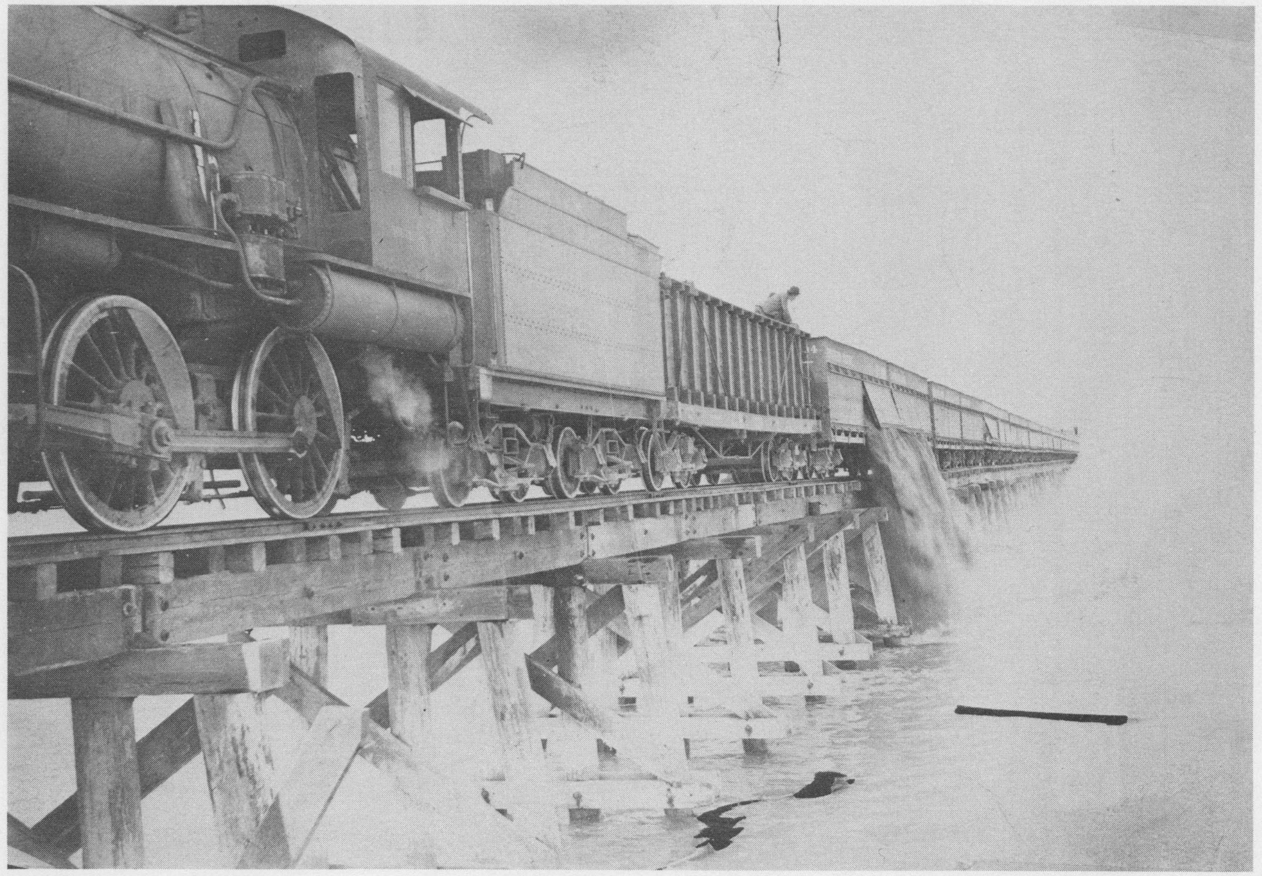
EN.M.GSL.LEVELS

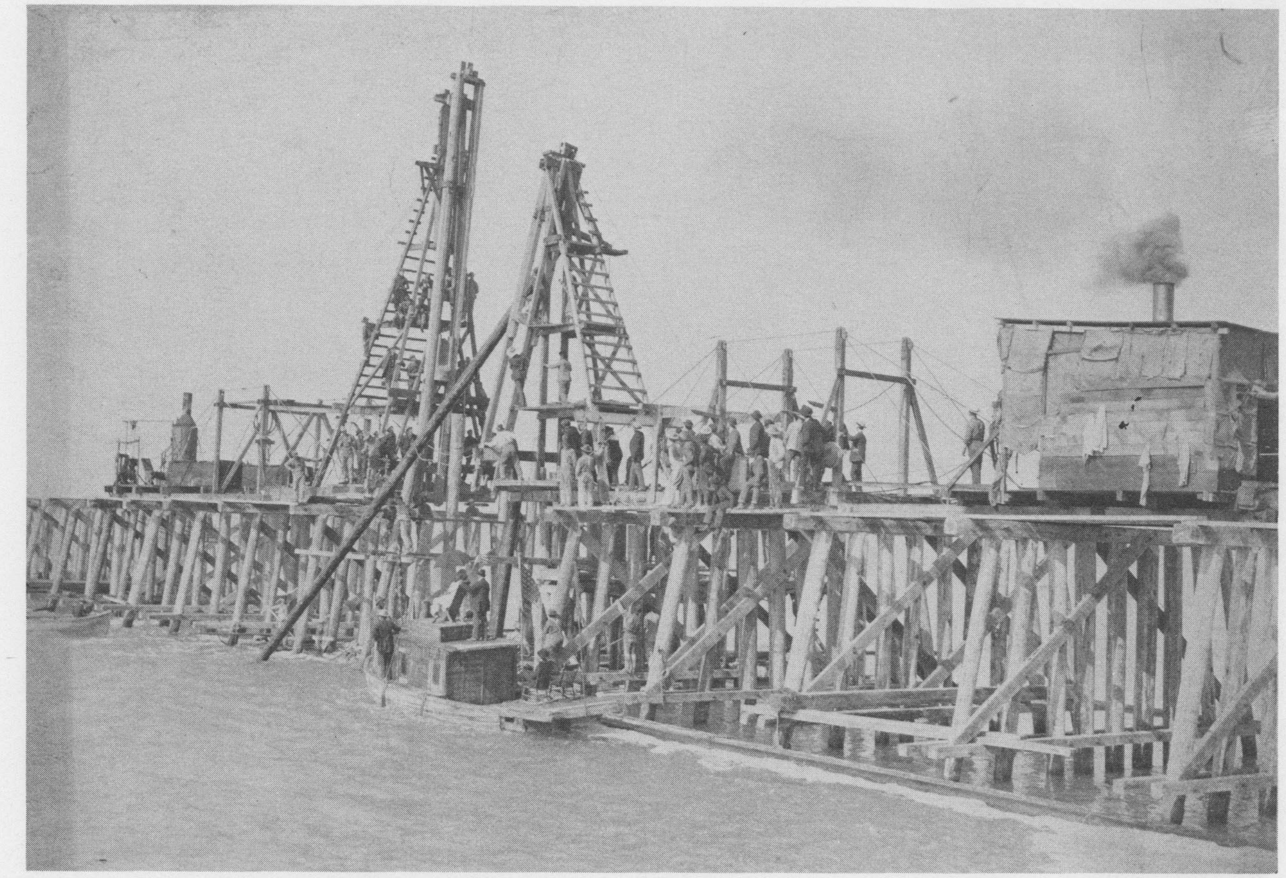
SOUTHERN PACIFIC
TRANSPORTATION COMPANY
GENERAL ENGINEERING OFFICE

ELEVATIONS OF
THE GREAT SALT LAKE

SCALE AS SHOWN	
VAL.SEC. SHEET	DRAWN BY RK CHECKED BY
ROUTE NO. M.P.	DRAWING NO.
DATE SEPT. 29, 1987	SHEET NO.
REVISED TO	FILE DRAWER

Elevations of The Great Salt Lake





CONSTRUCTION OF THE CENTRAL PACIFIC

The Pacific Railway Bill, authorized by President Lincoln, specified that the Central Pacific (predecessor of the Southern Pacific) should build a railway eastward from Sacramento, California, to meet the Union Pacific which was building westward from Council Bluffs. Construction of the Central Pacific began in January 1863. By June 1868 the Central Pacific had crossed the Sierras and was racing toward the Great Salt Lake and a meeting with the Union Pacific.

When the Central Pacific was being constructed, consideration was given to crossing the lake. However, the lake at that time was at one of its high periods (very close to the 1986-1987 elevation) and as speed of construction was essential, a route around the north end of the lake was adopted. The Pacific Railway Bill under which both railroads were built, carried a grant of $25,000 per mile. Consequently there was no incentive to locate the shortest line: also, to avoid heavy grading, contours were followed where possible. On May 10, 1869, the Central Pacific and Union Pacific met at Promontory, Utah, where a golden spike was driven when the last rail was laid.

CONSTRUCTION OF THE 'LUCIN CUT-OFF'

After 1873, the level of the lake began to decline and by 1900 it had dropped nearly 15 feet. Also, during the same period from 1869 to 1903 the "as constructed" Central Pacific between Reno and Lucin had been greatly improved. Some 202 miles of new railroad had been built & 360 miles abandoned with a large reduction in grade and curvature. However the section of railroad between Lucin and Ogden was a bottleneck with many 10 degree curves and curve compensated 2.2 per cent ruling grade.

The decision was made to investigate alternate routes, including several routes across and south of the lake to Salt Lake City. However, since the desired terminus was at Ogden, the directors of the Central Pacific instructed that the lake be crossed on the most direct route.

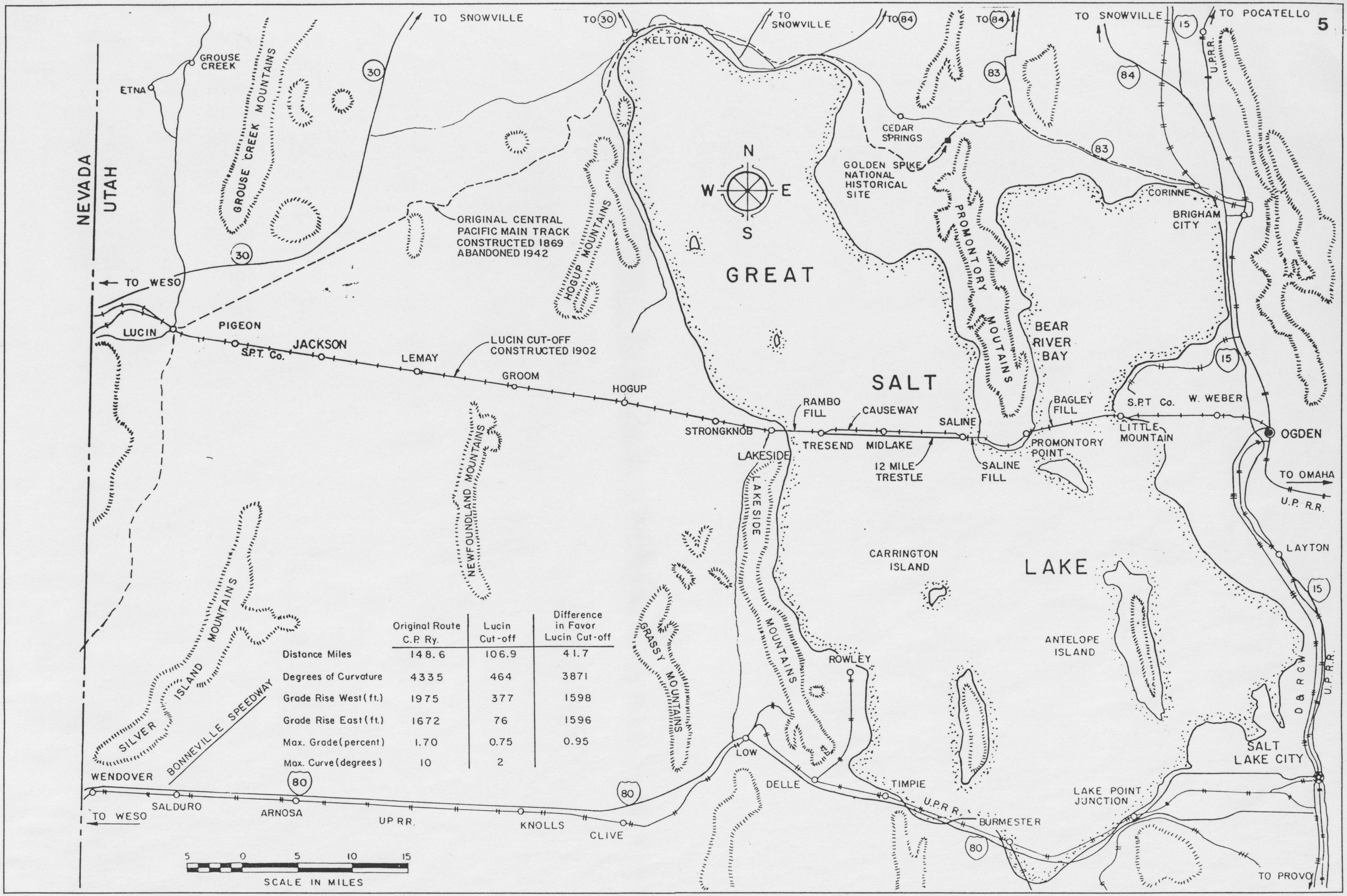
The new route, known as the "Lucin Cut Off" greatly reduced the distance, grade and curvature of the original route as shown on the next sheet, drawing CE 41873, sheet A-2.

Construction of the cut-off began August 21, 1902 and the line was turned over to the Operating Department on December 8, 1904. The lake crossing required approximately 28 miles of embankments and a 12-mile trestle. The top of the tie elevation of the trestle was built at 4,218.25 and the embankments were constructed at 4,213.25. Over 7.8 million cubic yards of fill material were placed in the embankments. Nineteen pile drivers were used to build the 12-mile timber trestle. Some 38,000 piles, varying in length from 80 to 130 feet were driven to provide five piles per bent. Brace piling and two additional piles per bent were driven in the 1930's and 1940's.

Over 3,000 men were employed during the construction of the crossing. It was estimated that with traffic of ten trains per day each day, the cut-off would save $214,000 per year (1902 dollars).

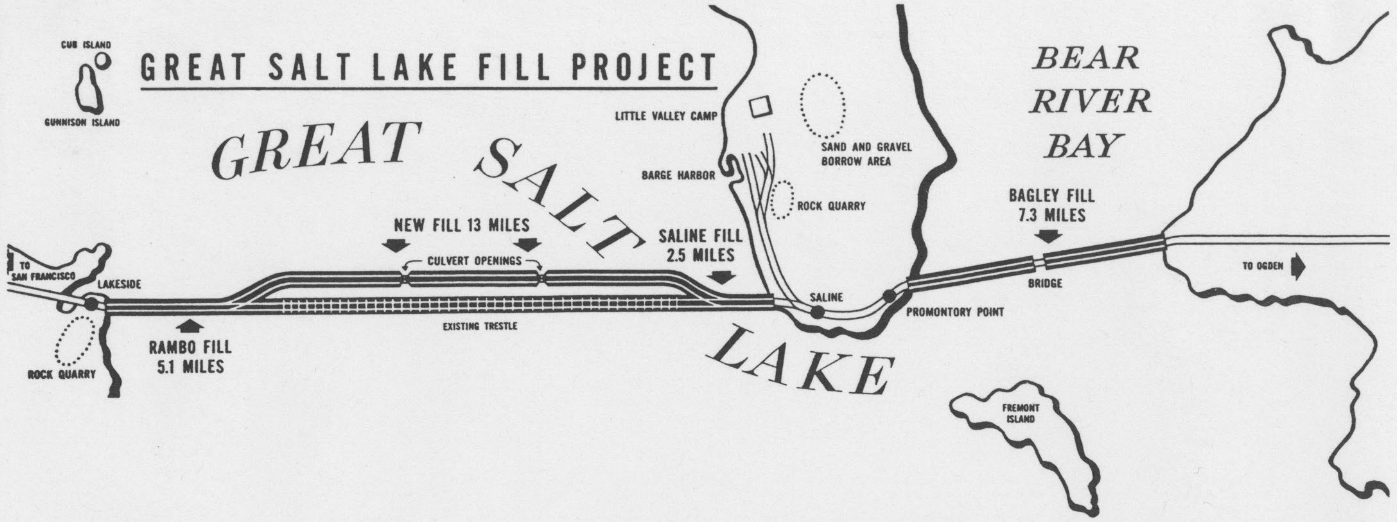
SP Southern Pacific Transportation Company Engineering - CADD Bureau

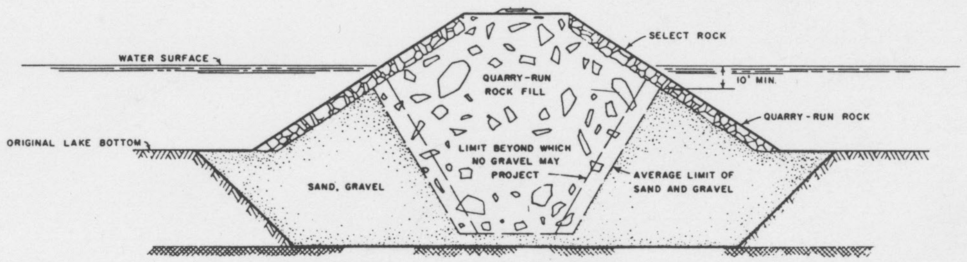
EN.M.GSL.LUCIN-CUT-OFF



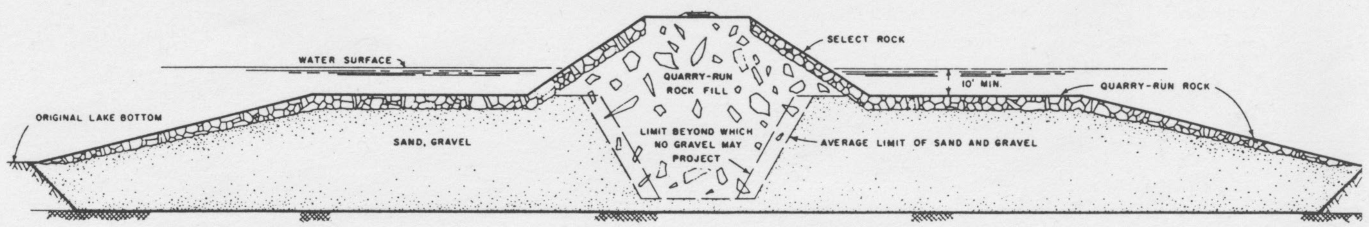
	Original Route C.P. Ry.	Lucin Cut-off	Difference in Favor Lucin Cut-off
Distance Miles	148.6	106.9	41.7
Degrees of Curvature	4335	464	3871
Grade Rise West (ft.)	1975	377	1598
Grade Rise East (ft.)	1672	76	1596
Max. Grade (percent)	1.70	0.75	0.95
Max. Curve (degrees)	10	2	

9-17-87 C.E. 41873, SHEET A-2
Dr. W.D.P.P.

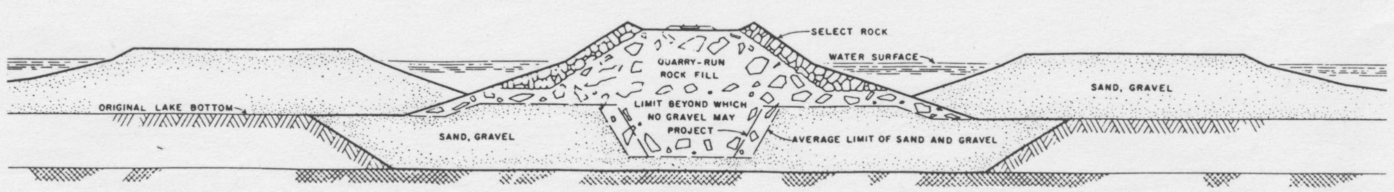




ORIGINAL DESIGN SECTION
SALT FOUNDATION



ORIGINAL DESIGN SECTION
CLAY FOUNDATION



SPECIAL DESIGN SECTION

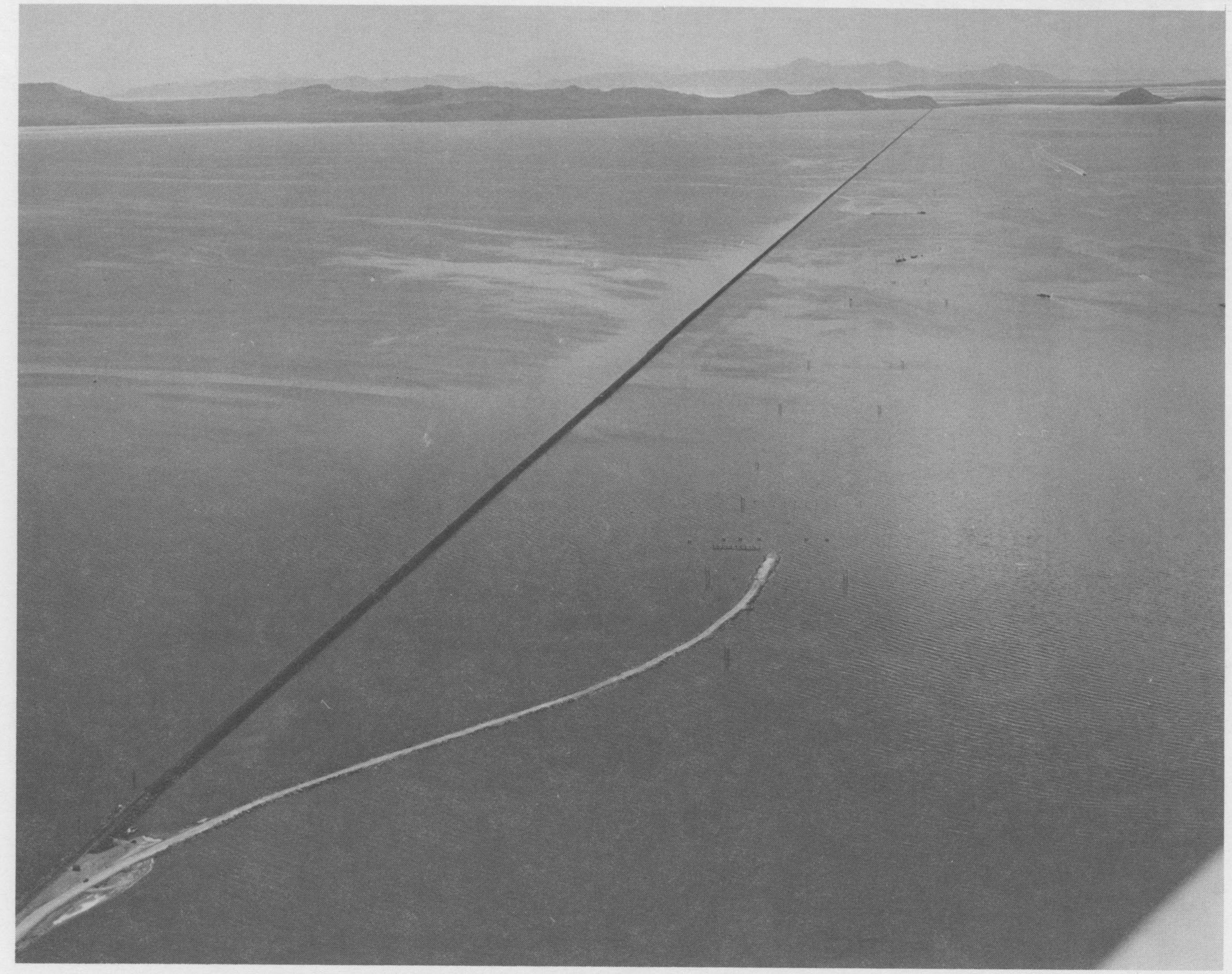
THE NEED TO REPLACE THE TRESTLE

By 1950, the 12 mile timber trestle was nearly 50 years old, maintenance costs on the trestle were increasing steadily under heavier loadings and the wear and deterioration of the timber. Train speeds were restricted 20 miles per hour to reduce impact and sway.

In 1953 a detailed engineering steady of the trestle indicated that superstructure above the pile caps would need replacement within seven years and that the pile would require replacement within 25 to 30 years. Since traffic had to be maintained during the repair period, the option of rehabilitating the trestle was determined to be not acceptable.

A feasibility and economic steady was made to determine if the trestle should be replaced with a new concrete trestle or an embankment fill

A detailed engineering study performed by International Engineering in 1954 and the Southern Pacific concluded that a sand, gravel, and rock-fill embankment was feasible and would be most economical alternative to replace the trestle.



DESIGN OF THE GREAT SALT LAKE CAUSEWAY

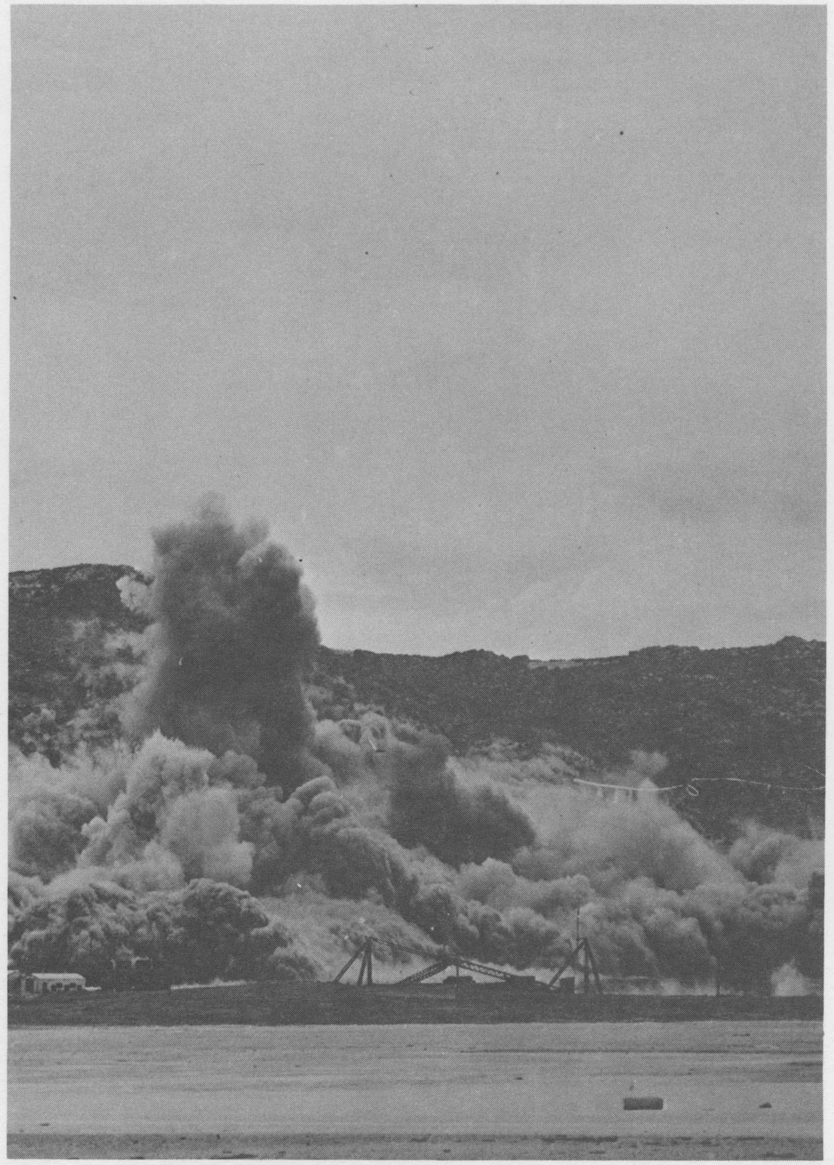
In May 1955 a contract was awarded to International Engineering to design the embankment under the direction of a board of consultants and review by Southern Pacific.

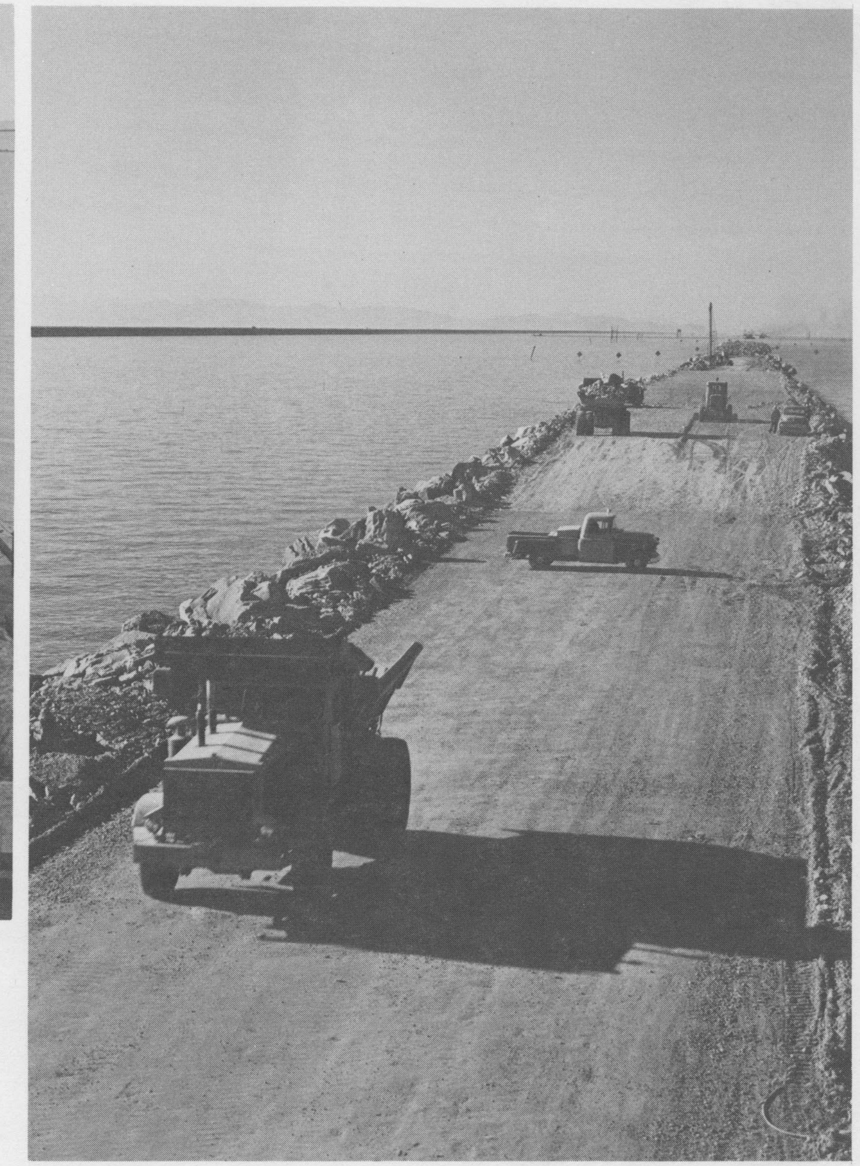
The board consultants consisted of Dr. Arthur Casagrande, Mr. R. R. Philippi, Mr. F. H. Kellogg and Mr. S. D. Wilson.

The embankment would be constructed 1500 feet from the existing trestle to avoid damage to the trestle and interruption to traffic.

The lake along the proposed embankment alignment was 30 feet deep. The foundation material in the lake bed was very soft, interlayered silty clays with a significant organic content.
The consistency of the upper 20 to 30 feet of clays was that of toothpaste. The easterly two-thirds of the embankment alignment was underlain by a layered deposit of Glauber's salt about 20 to 30 feet below the lake bottom.
The salt layer varied in thickness from 2 to 3 feet on the west end to more than 30 feet on the east end.

The results of the foundation tests and analysis indicated that a stable fill could be built by dredging the upper 20 to 25 feet of soft clays and backfilling the trench with sand and gravel.





CONSTRUCTION

Construction of the embankment was awarded to Morrison-Knudsen Company of Boise, Idaho, in 1956 The total cost of the project, including the embankments, culverts, exploration, engineering, and railroad track and signals was about $53 million.

A construction camp was established at Little Valley close to supplies or rock, sand and gravel. The camp was equipped with facilities to supply the construction efforts and housed a maximum population of 1,300 workers and their families.

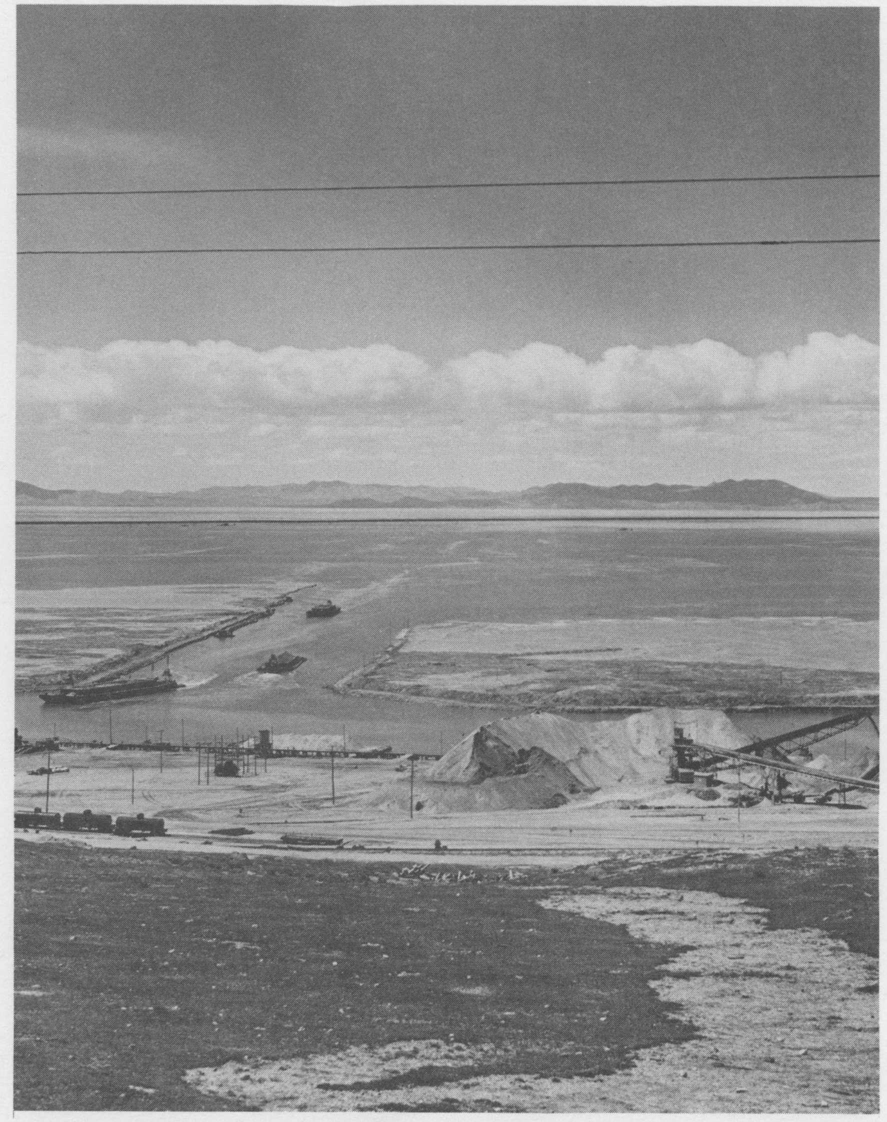
A flotilla of barges, dredges, tugs, and workboats were used to build the embankment. Six of the largest bottom dump barges ever constructed each capable of holding 2000 cubic yards, were assembled at the site.

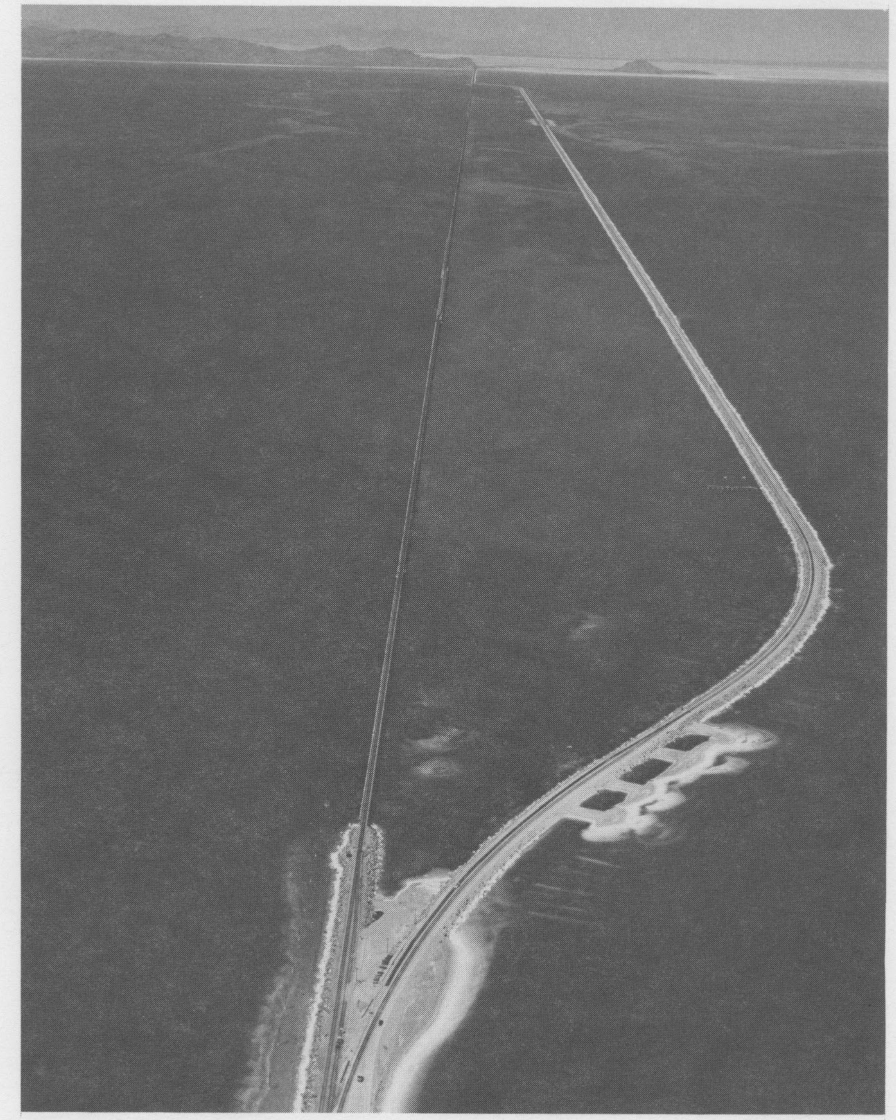
The marine equipment also included two large dredges, five flat deck 1000 cubic yard barges, six 1000 horsepower tugboats, two 600 horsepower tugboats and 14 small powerboats.

The land equipment used to mine and haul the rock, sand and gravel to the Little Valley harbor included 6 electric Bucyrus Erie shovels, 3 diesel shovels, 28 Euclid 27 cubic yard bottom dump trucks and a high capacity belt conveyor.

Several very large blasts were made to produce the quarry-run and select rock respectively used in the embankment core and slopes. One of the blasts consisted of 1.8 million pounds of explosive (ammonium nitrate and 25 percent conventional explosives) and produced approximately 4 million tons of rock. Another blast consisted of 2.14 million pounds of explosives and produced 5.9 million pounds of the same rock.

The construction schedule called for the placement of 1.8 million cubic yards of embankment per month. For several consecutive months, the production exceeded 2.0 million cubic yards. The work began in March 1956 and the roadbed was completed July 1, 1959.



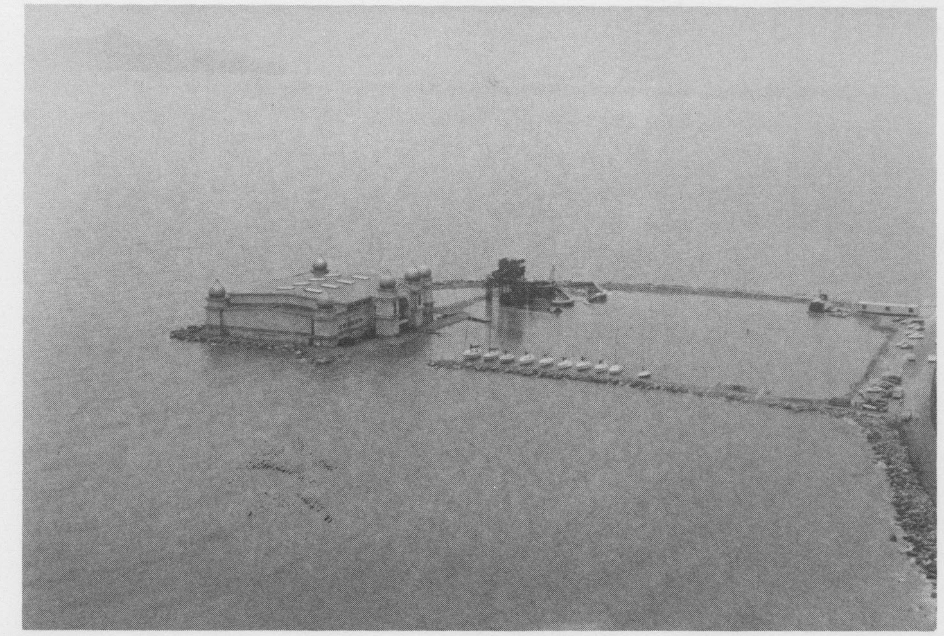


SOME ENGINEERING DATA FOR THE COMPLETED EMBANKMENT IS AS FOLLOWS:

Embankment length	12.68 miles
Rock placed in embankment	13,016,000 cy
Sand and gravel placed	32,464,000 cy
Total embankment materials	45,480,000 cy
Bottom width for embankment	175-600 feet
Max. height of embankment	97 feet
Design embankment crest elevation	4212 Hood's Datum
Max. depth of dredge cut	85 feet
Max.width of dredge cut	600 feet
Total dredging	15,350,000 cy
Max.quantity of fill placed in one month	2,400,000 cy
Total material handled	60,832,000 cy

SP Southern Pacific Transportation Company Engineering - CADD Bureau

EN.M.GSL.DATA



CAUSEWAY FOUNDATION PERFORMANCE SINCE CONSTRUCTION

The total average settlement of the causeway after one year of operation was one-foot, after five years 2 1/2 feet, and after ten years about four-feet. The average settlement since 10 years after construction has been 2 to 4 inches per year. Several areas on the causeway have experienced more settlement than the average, up to an average of 1/2 foot per year and a maximum settlement of 17 feet. Geotechnical stability analysis and experience gained during and after construction has determined that the placement of stabilizing or counterweight berms is the most effective means available to increase stability and decrease the high settlement rate.

CAUSEWAY SLOPE PROTECTION PERFORMANCE 1959 THRU 1982

The Great Salt Lake is subject to sudden and violent storms, with winds up to 70 mph. The winds generate waves that can reach 8 feet in height and have 20 percent more energy than the ocean due to the higher density of the lake waters. The height, length, and period of wind generated waves are determined by wind speed, fetch (the distance the wind blows over the water in generating the waves), and the length of time the wind blows. Generally, the longer the fetch, the higher the wind velocity and the longer the time the wind blows, the larger the waves. The calculated "design wave" which is the average of the highest one-third of all waves is 7.2 feet for the Great Salt Lake Causeway.

High winds and waves can occur all year around. However, most of the damaging wind and waves occur from the north, from April to July, and from the south, from July to August.

The wind storms also generate a wind setup or storm surge which piles up water against a barrier such as a coastline or the causeway. The wind setup is the mean height of the water pile up above normal lake level. Calculated and measured wind setup for the causeway during moderate to extreme wind storms varies from 1 to 2 feet.

The causeway was designed and constructed in 1959 to have a minimum freeboard (vertical distance from maximum water level in the lake to the top of the causeway slope protection) of ten feet. The slope protection design was based on the U.S. Army Corps of Engineers shore protection manual. The slope protection for the causeway is equivalent to a rubble-mound breakwater. Adequate slope protection was provided by utilizing very large 1 to 3 ton stones and placed on a 1.5 to 1 slope. The thickness of the large stone layer was 5 feet.

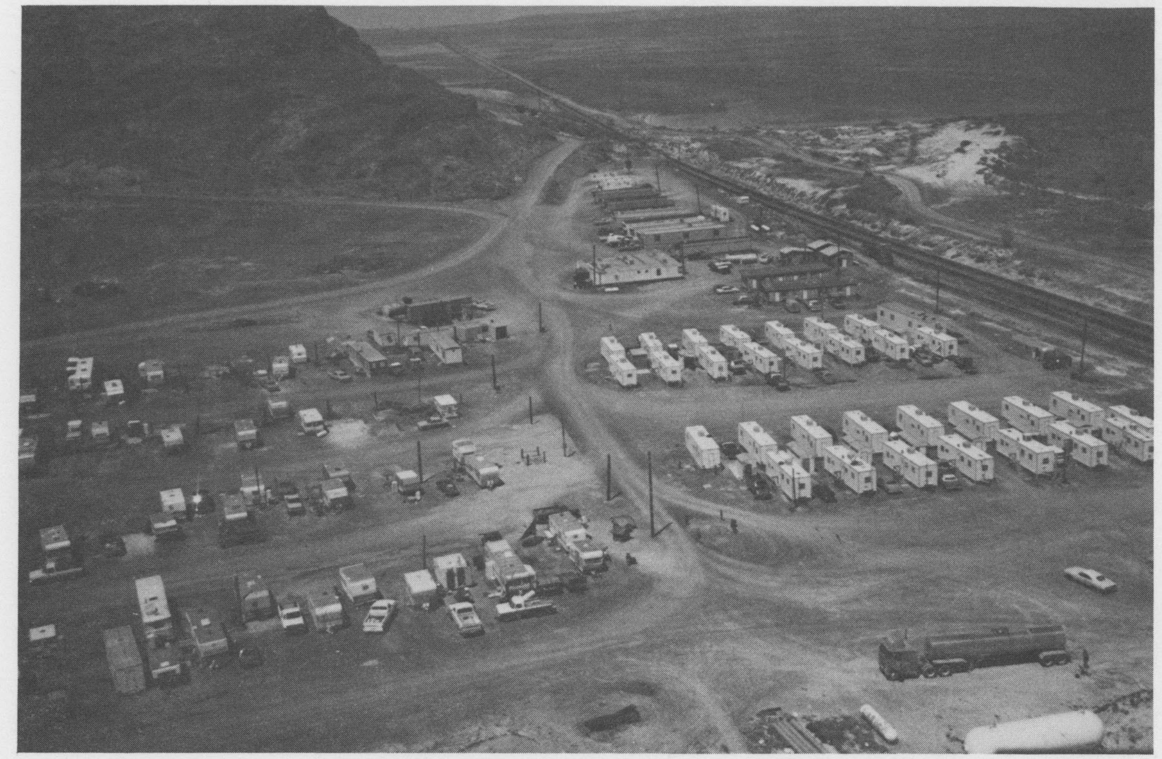
From 1959 till 1982 the freeboard varied from 17 feet to 8 feet. During periods of the higher water elevations and the low freeboard, the slope protection had some isolated areas that eroded and required repair. The salt spray from the waves also lowered the electrical resistance of the ballast and adversely affected the signal-system. However, these problems were relatively minor and the causeway proved to be a reliable high speed crossing of the lake.

THE BATTLE TO KEEP ABOVE THE RISING LAKE

The lake began an unprecedented rising trend that started in September 1982. In 9 months, from September 1982 to May 1983, the lake rose a little over 5 feet. The trend continued from 1983 to 1984 when the lake rose another 4.5 feet and from 1985 thru 1986 when the lake rose another 3.5 feet. All told, the lake rose over 12 feet in three and one-half years, from elevation 4203 to over 4215.

In January of 1983, the average elevation of the crest of the fills crossing the lake was 4209 to 4210 with some isolated areas as low as 4207. In 1983 there were approximately 30 miles of fills crossing the lake and 60 miles of exposed slopes. By 1987, the fills crossing the ever expanding lake would increase to 60 miles with over 105 miles of slopes to protect.

The Southern Pacific was faced with the monumental problem of raising the track and fills, constructing slope protection, constructing bridges, repairing storm damage, and maintaining revenue freight service.



THE LAKESIDE QUARRY

Southern Pacific is very fortunate to be the owner of a large quarry located on the west side of the lake at Lakeside. There are actually two rock quarries and a gravel pit located at Lakeside. The east rock quarry and gravel pit have not been utilized in recent years. The west quarry has been extensively developed and utilized, especially since 1983.

The west quarry is composed of a dark grey and blue massive limestone (Mississippion Great Blue). The limestone has a natural joint spacing that is described as wide (3 ft. to 10 ft.) to moderately close (1 ft. to 3 ft.). Some parts of the quarry have been fractured by several large blasts set off in the late 1950's.

Since 1983, the Lakeside Quarry has been operated under contract with two contractors - Robert L. Helms Construction and Development Company of Sparks, Nevada and the Lost Dutchman Construction Inc. of Reno, Nevada.

The quarry constractors (currently R. L. Helms) mine the quarry by developing a series of benches or terraces and removing the mountain from the top down.

The quarry contractor is required to separate or " size " the mined rock into three sizes. The largest rock mined is 1 ton or greater in weight (nominally sized 3 feet and larger) and is termed Armor Stone. The intermediate size rock must weigh from 250 to 500 pounds (nominally sized 1 foot to 3 feet) and is termed Underlayer Stone. The blasted rock remaining after the Armor and Underlayer is removed is call Quarry Reject (nominally sized 1 foot minus).

The Quarry Reject is also used to make ballast by processing through a crusher and screens. The ballast gradation is nominally size from 1 1/2 inch to No.4. The material which passes through the ballast screens (nominally 3/8 inch minus) is called crusher reject and makes an excellent road capping material.

The ratio of the various rock sizes produced by the quarry is roughly 9 to 15 percent Armor Stone, 30 to 35 percent Underlayer Stone, and 55 to 65 percent Quarry Reject. Since 1983, the following approximate quantities of the various size stone have been produced by the Lakeside Quarry.

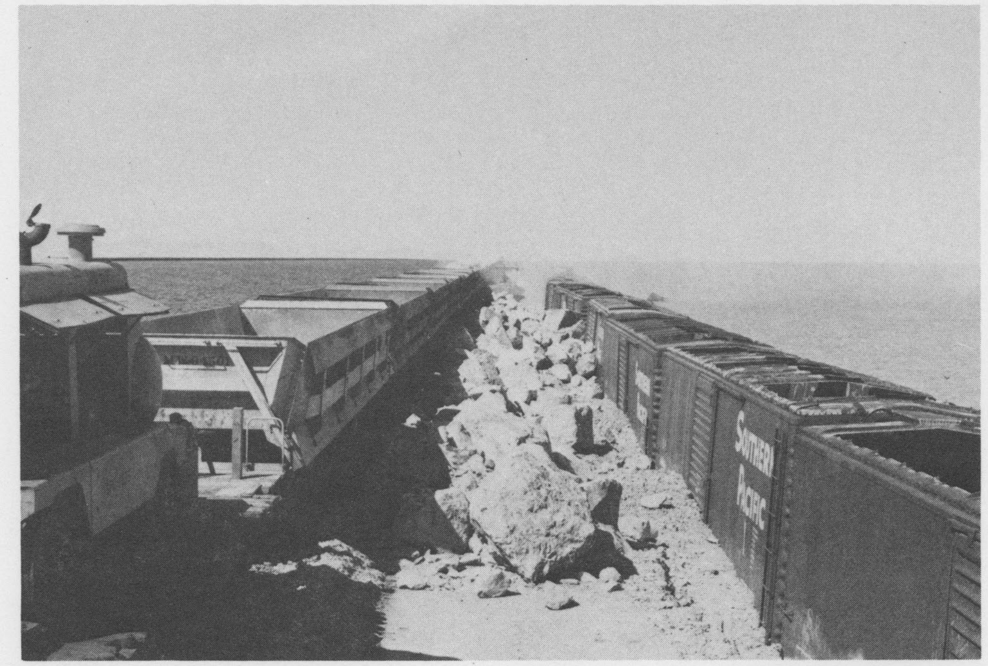
Armor Stone	-	550,000 tons
Underlayer Stone	-	1,700,000 tons
Quarry Reject	-	2,500,000 cubic yards
Ballast	-	800,000 tons

The quarry has several long loading tracks which allow the simultaneous loading of two 50 car strings of air side dumps and a 30 car string of bottom dump hoppers. The contractor is required to load the 50 car string in less than an hour and a half but generally loads the string in less than on hour.

THE LAKESIDE CAMP

The railroad construction camp at Lakeside has been in existence since 1901. Since 1983, the population has varied from a low of 20 in 1983 to a high of over 350 construction workers and their families in the fall of 1986. There is no potable fresh water within 40 miles of Lakeside so all water is brought in by railroad tank car or is trucked in. Also, there is no commercial electrical service at the camp. All electrical power is generated by 1 main diesel generator and 2 stand-by generators.

A large diner, operated by Milepost Inns and subsidized by the Southern Pacific is kept open around the clock to serve meals to the work train crews, construction personnel, and other occupants of the camp.



THE BREACH BRIDGE (STRUCTURE 735.46)

The Great Salt Lake causeway which was built in 1959 was constructed with sand and gravel with the upper portion constructed of large quarry-run rock. In addition two large box culverts each 15 feet wide by 20 feet high were constructed. The combination of the permeable fill and the culverts allowed the brine waters of the Lake to move north and south through the causeway.

By spring of 1984, the very large inflows to the south arm of the lake had created a difference of water levels of nearly 3.5 feet.

As a flood control measure, the State of Utah requested that a 300 foot bridge opening be constructed in the Rambo fill just off shore from Lakeside.

The bridge is a double track structure with an adjacent highway bridge. The bridge is 300 feet long and is supported by alternating 10 and 14 pile bents that are founded on a 10 foot thick cemented oolite layer located about 45 feet below the bottom of the cap. The piles are 18 inch square precast prestressed piles. The abutment consists of 21 inch by 40 inch precast prestressed concrete sheet piles.

The superstructure is composed of precast prestressed concrete box girders with a 30 foot span for the railroad bridge and a 60 foot span for the highway bridge.

Because of the extremely corrosive nature of the lake, all concrete elements are of a special high density, impermeable mix with non reactive aggregate and type V cement. All reinforcing steel is epoxy coated.

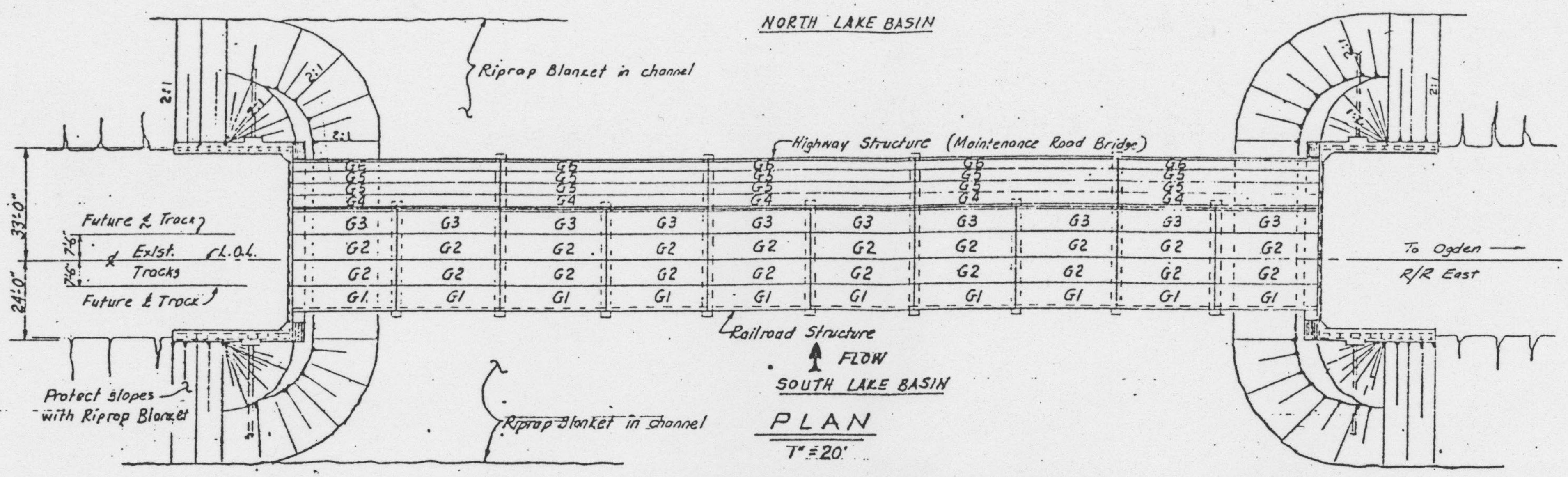
The bridge was designed and the construction managed by Southern Pacific, J. H. Pomeroy of Petaluma, California, assisted with the design, furnished the precast elements and constructed the bridge.

The bridge was constructed in approximately 3 months.

The bridge was successful in lowering the head differential from over 3.5 feet to less than 8 inches. The opening later become an integral part of the West Desert Pumping Project.

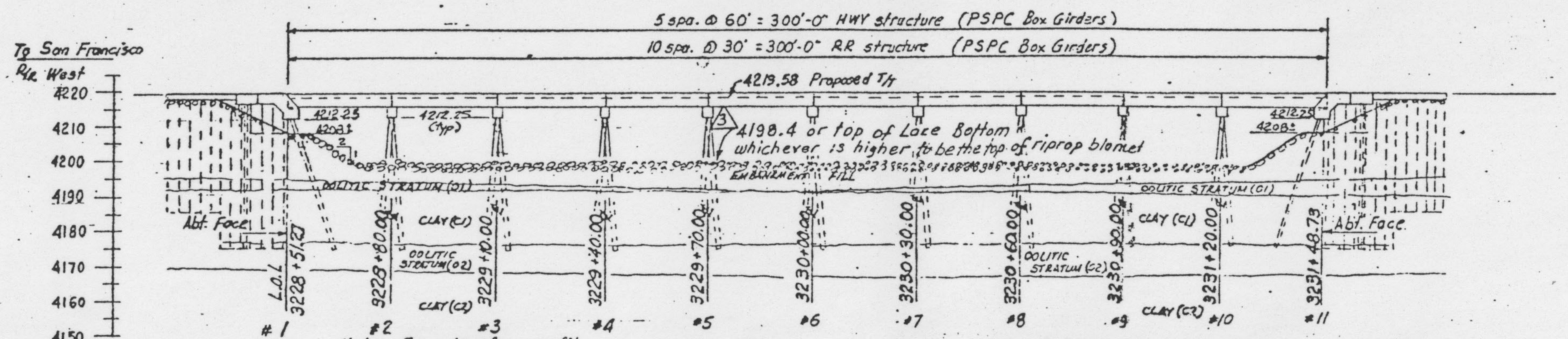
THE " BOX CAR SEAWALL "

In spring and summer of 1983, the lake was rising at such a rapid rate that an interim " quick fix " solution to protect the extremely vulnerable north slope was required. The decision was made to utilize surplus scrap box cars to create a " box car seawall " on the north side of the Great Salt Lake causeway. From mid-August to September 1983, 1430 scrap cars were placed end to end on the north side of the causeway. The trucks were removed from the cars and the tops of the cars were removed except for the center one-third. The cars were then filled with quarry-run rock. The boxcars provided significant protection for about 2 years and bought some valuable time which allowed the tracks and fill to be raised. The " box car seawall " cannot be seen currently because it has been buried by subsequent raising of the fills and placement of large rock slope protection on top of and outboard of the boxcars.



PLAN

1" = 20'



Note: For subsurface profile refer to Haley and Aldrich, Inc. drawing and data report dated March 15, 1984

2 Note: All sheetpiles shall be driven to a minimum capacity of 30 tons. All front wall and 5 adjacent wing wall sheetpiles shall be fitted with protruding steel points and shall be driven to place the full length of steel point within the oolitic stratum (O2). Each of above sheetpiles shall be driven to the tip elevation indicated in the following table:

Location	Highest Allowable Tip	Lowest Allowable Tip
West Abutment	4175.0	4169.0
East Abutment	4172.0	4168.0

All remaining wing wall sheetpiles do not require protruding steel points and shall be driven to a minimum tip elevation of 4195.0 for both Abutments.

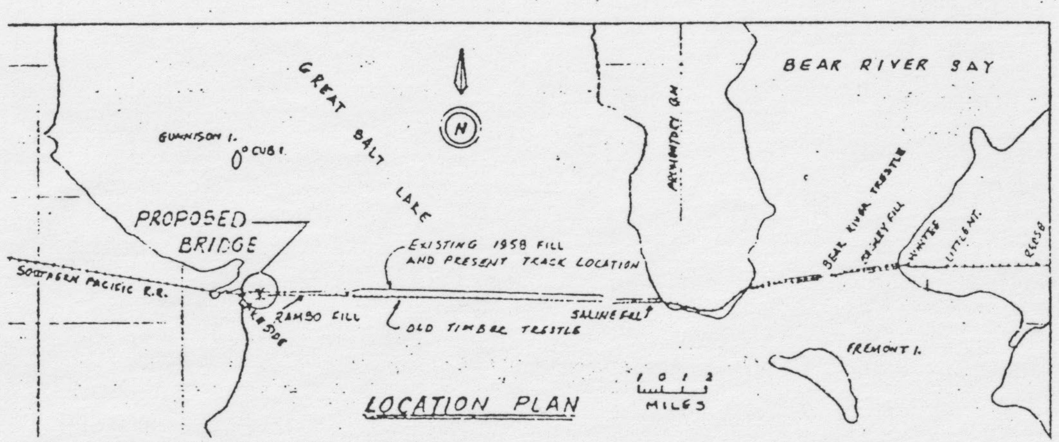
ELEVATION

1" = 20'

Note: Each pile shall be driven to bearing in an oolitic stratum to a minimum capacity of 60 tons. Each pile shall be driven to the tip elevation indicated in the following table:

Engineering Station	Highest Allowable Tip	Lowest Allowable Tip
3228+25 to 3229+50	4175.0	4169.0
3229+50 to 3230+10	4174.5	4169.0
3230+10 to 3230+70	4173.0	4167.0
3230+70 to 3231+65	4172.0	4168.0

The average hammer blows per inch of penetration for the final six inches shall be minimum of 6 blows per inch. If an abrupt increase in driving resistance is encountered, the driving shall be terminated when the pile penetration is less than ½ inch in ten successive blows, providing that the pile tip has reached an acceptable elevation. Final penetration resistance may be changed based on proposed pile driving equipment.



LOCATION PLAN

DATUM All elevations are in feet and are based on Hood's datum = U.S.G.S. datum + 3.4 ft.

LIST OF DRAWINGS

C.E. No.	SH. No.	DESCRIPTION
36512	1	GENERAL PLAN
"	2	BENT LAYOUT
"	3	ABUTMENT LAYOUT
"	4	ABUTMENT DETAILS
"	5	30 FT. PSPC GIRDER DETAILS
"	6	60 FT. PSPC GIRDER DETAILS
"	7	PILE DETAILS
"	8	SUBSURFACE PROFILE
35662	24a	EPOXY SPECS & MIXING

GENERAL NOTES

Specifications:

Railroad Structure - Current A.R.E.A. specs for design, materials and construction manual chapter 8, unless otherwise noted.

Highway Structure - Current A.A.S.H.T.O. specs for design highway bridges.

Design Loads:

Railroad Structure - Coopers E-72 loading.

Highway Structure - HS20-44 truck loading.

Concrete:

Concrete for prestressed concrete girders, prestressed concrete piles, prestressed concrete sheetpiles, cast in place concrete on bent caps, abutment caps, backwalls and wingwall cap beams shall have a minimum compressive strength as indicated in drawings.

Concrete mix shall be designed by supplier using a sulphate-resisting portland cement conforming to ASTM Designation C150, Type V, with an upper limit of 5% for the content of tricalcium aluminate (C_3A).

Concrete shall be composed of cement, sand, coarse aggregate, and water, all properly proportioned, well mixed, and brought to the proper consistency. It is necessary to provide a concrete that will be strong, sound, dense, impermeable and durable despite the severe saline and sulfate alkali exposures.

Concrete mix-proportions, water-cement ratio, and the operations of mixing, forming, placing and curing shall be submitted by supplier for approval by the Engineer prior to casting.

Prestressing Steel:

All prestressing steel shall conform to ASTM Designation A416 grade 270.

Reinforcing Steel Epoxy Coated:

All reinforcing steel to be used in prestressed box girders, concrete sheetpiles, cast in place concrete for bent caps, abutment caps, backwalls and wingwall cap beams shall be deformed epoxy-coated conforming to ASTM Designation A775-81 grade 60. Thickness of coatings to be 7 mils plus or minus 2 mils.

Spiral Wire for Concrete Piles:

Spiral reinforcement on prestressed concrete piles shall be cold drawn wire conforming to ASTM Designation A-82

Reinforcement Cover:

All reinforcement in prestressed precast, or cast in place concrete shall have 3 inches minimum cover unless otherwise noted.

Concrete Bearing Piles and Abutment Sheetpiles:

Bearing Piles - 18 inch square solid core prestressed concrete pile - Pile design capacity 60 tons each.

Abutment Batter Piles - Similar to bearing piles

2 Wall Sheetpiles - 21" x 40" prestressed concrete sheetpile. Sheetpile capacity 30 tons each.

Bearing piles and sheet piles shall be driven per Haley and Aldrich, Inc. Geotechnical Consultants recommendations.

Surface Treatment of Concrete:

Piling (18" sq. & sheetpile) - See Sheet 7 for treatment

Box Girders - See Sheets 5 & 6 for treatment

Cast-In-Place Concrete - Apply "Chem-Trete-BSM" (or approved equal) to all surfaces per manufacturer's specs.

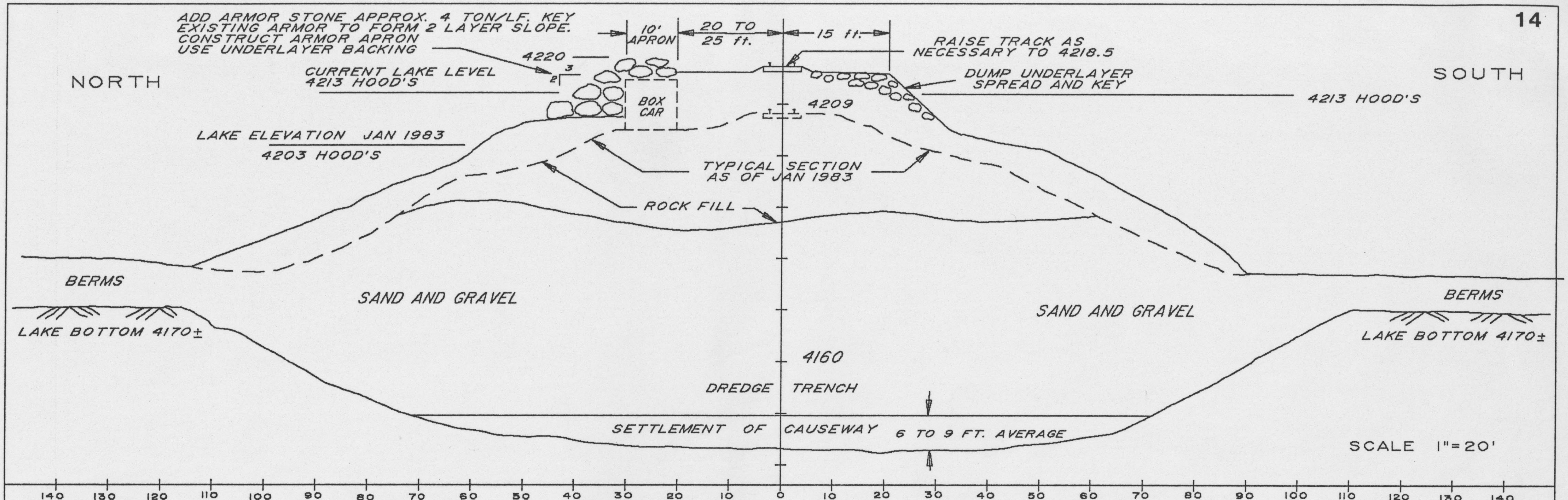
REVISIONS

No.	DESCRIPTION	DATE
1	Bottom of cap elev. indicated	4/12/84
2	Sheet pile driving note	4/12/84
3	Rev. of channel Bott. Elev.	5/18/84

SOUTHERN PACIFIC TRANSPORTATION CO.
GENERAL ENGINEERING OFFICE
SAN FRANCISCO, CALIFORNIA

PROPOSED 300 FT. R/R BRIDGE
G.S.L. RAMBO FILL - LAKESIDE
GENERAL PLAN

DESIGNED BY	N.G.P./CRS	STRUCTURAL DEPARTMENT	BRIDGE
DRAWN BY	N.G.P.	DRAWING No.	CE 36512
CHECKED BY	M.K.M./CRS	SHEET No.	1 of 8
SCALE	AS NOTED	CASE	DRAWER 1202
DATE	3-16-84		



TYPICAL SECTION GREAT SALT LAKE CAUSEWAY

RAISING THE TRACK AND FILLS

In order to keep ahead of the rapidly rising waters, the tracks and fills had to be quickly raised. Between Milepost 724 at Hogup to Milepost 767 at Little Mountain nearly 59 miles of main line and sidings had to be raised between 6 and 10 feet to keep a bore minimum free board of 2 feet between the static lake level and the fill crest. This meant that the tracks alone had to be raised 100 foot-miles in 1983, 150 foot-miles in 1984, 75 foot-miles in 1985, 50 foot-miles in 1986, and 25 foot-miles in 1987. (A foot-mile is one mile of track raised one foot). During peak production the track was raised an average of one-half to one foot-mile per day with the use of on track hydraulic liner/lifters (shifter/lifters), tampers and off-track backhoes. Over 500,000 tons of crushed ballast from the Lakeside Quarry have been used to raise the tracks The crest or roadbed of the fills were raised utilizing over 3 million cubic yards of quarry-run rock. Over 90 per cent of the fill material was quarry-run rock from the Lakeside Quarry and the remainder was pit run sand and silt from a track-side pit located at Promontory. All of the material to raise the fills was transported by air side dump cars. Southern Pacific possesses a fleet of about 100-50 cubic yard side dumps and 100-35 cubic yard side dumps. In addition 60 more 50-cubic yard side dumps were obtained on a long term lease from the Kennecott Copper mines at the south end of the lake. All 260 side dump cars were simultaneously pressed into service transporting material to raise the fills and protect the slopes. During peak periods, over 400 carloads a day were placed on the fills utilizing from two to four work trains.

The current top of rail elevation from Lakeside to Hogup varies from 4218.5 to 4219.5 Hood's Datum (4215 to 4216 USGS) and the crest of the fill or roadbed elevation is about 1 to 1.5 foot lower. If the lake continues on a downward trend, no further out-of-face raises are proposed. Spot surfacing to provide a consistent level elevation will be performed.

During 1983 and 1984, Southern Pacific retained a consulting geotechnical engineering firm, Haley and Adrich of Cambridge, Massachusetts to determine the impact of raising the causeway approximately 10 feet. After an extensive boring program, labortory analysis, and stability analysis Haley and Aldrich's conclusion was that the causeway could be raised but that some known weak areas would have to be closely monitored, especially when the lake drops 10 feet near elevation 4205.

CURRENT SLOPE PROTECTION PROGRAM

From 1983 to 1986, most of the resources and work effort were oriented towards raising the track and fills above the rising lake. During these three years, interim slope protection measures that could be quickly placed, such as the box car seawall were used. In addition, large quantities of quarry-run rock combined with Underlayer and Armor size were dumped on the slopes without keying or placement in layers.

With assistance from the consultants, Haley and Aldrich, and experience gained by Southern Pacific in the past 3 years, a slope protection design and program has been developed that provides a more permanent, low maintenance protection against the spring and summer storms that occur on the lake.

The most vulnerable part of the crossing is on the north side in the middle of the lake from Milepost 740 to Milepost 752 where 7 to 8 foot waves are generated during 60 mph winds. A stone revetment consisting of 2 layers of Armor Stone (Lakeside Quarry rock 1 ton and larger) will be placed up the face of the slope. A 10 foot wide over topping apron will also be constructed. Underlayer rock will be used under the Armor to act as filter and support. The Armor layer maintains its position under wave action through a combination of weight and interlocking with the other stones.

The Armor Stone revetment is placed with large hydraulic excavators (Cat 245 backhoe) at the approximate rate of 100 lineal feet per day . About 5 tons of Armor Stone and 5 tons of Underlayer Stone per lineal foot of slope is dumped and then keyed and interlocked with large stone previously dumped but not keyed in the past 3 years.

The remainder of the slopes on the crossing will be protected with either Underlayer size stone or quarry reject.

THE NEED FOR A SOLUTION TO THE FLOODING PROBLEM

Since its historic low in 1963, the Great Salt Lake has risen nearly 20 feet which has essentially doubled its area and tripled its volume. Almost half of the increase in lake depth, area and volume has occurred since 1982. The rapid rise of the lake has caused an estimated $250 million in damages to industries, recreation and wildlife areas, highways and railroads. If the lake continued its rise to 4217 USGS (4220.4 Hood's) the flooding damages were estimated to increase to $1 billion.

In response to the threat of flooding and the resulting damage, the Utah Division of Water Resources began feasibility studies to control the lake level. Alternatives studied included diking low areas around the lake, diverting and developing water upstream before it enters the lake, and pumping water into a natural basin or depression west of the lake.

The concept of pumping water into the west desert was determined to be the only viable alternative. Detailed feasibility and engineering studies were performed by the West Desert Group, a joint venture of Eckhoff, Watson, and Preator of Salt Lake City and Morrison-Knudsen Engineers of San Francisco. Because the Southern Pacific tracks were located within the project limits, the SP Engineering Department worked closely with the West Desert Group throughout the development of the project.

Development of the final design was authorized by the State of Utah during 1985. An Enviormental Impact Statement was issued in February 1986 by the Bureau of Land Management and published in July 1986. Construction and first year operating costs are funded with a $60 million appropriation by the State in Spring of 1986.

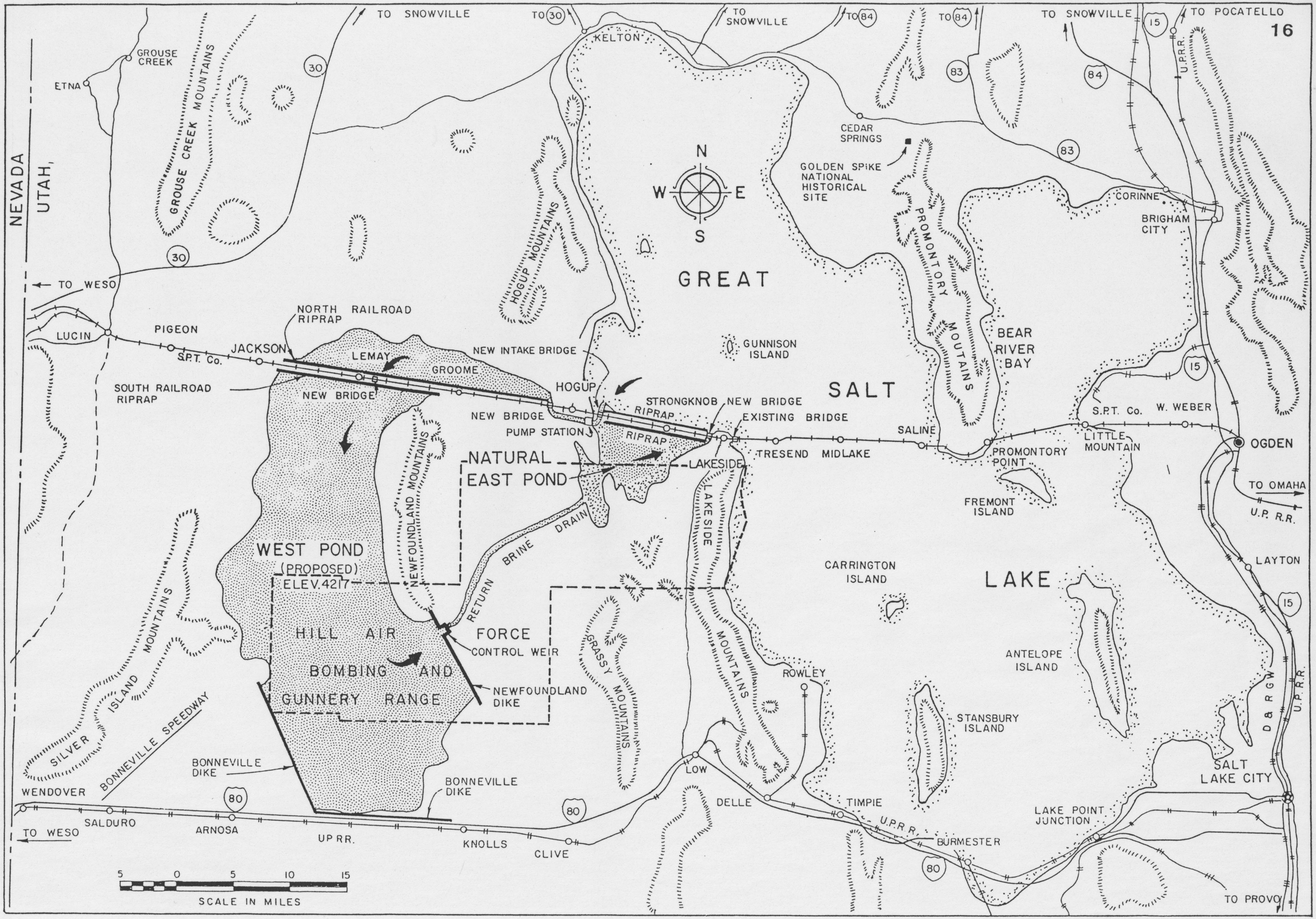
Before the project plans were finalized and contracts awarded, a violent wind storm hit the lake in June 1986. Damage to the SP's lake crossing was sustained along the 40 miles of fill, but especially the 10 miles of fill from Lakeside to Hogup. This fill would also serve as the main access to the proposed pumping plant. Because of the State's urgent need to get the West Desert Project underway and SP's urgent need to rebuild the 10 mile fill and resume freight service - SP negotiated a contract wereby it assumed the role of a general contractor to reconstruct the embankment and access road, excavate the outlet canal, construct four bridges and raise its embankment west of Hogup.

FEATURES OF THE WEST DESERT PUMPING PROJECT

The main operational features of the pumping project consist of a pumping plant, a discharge canal and the West Pond. The project also includes a 10 mile access road (jointly used with SPRR), 4 railroad bridges to allow circulation of the the brine water, a 24 mile long raised railroad embankment through the West Pond, and 2 dikes to contain the 500 square mile West Pond.

Three large pumps will lift the lake waters approximately 17 feet to a 4 mile long outlet canal. The pumps are rated at 1000 cubic feet per second each and will pump nearly 2 million acre-feet of lake brine into the West Pond each year. The large surface area (320,000 acres) and shallow depth (average depth 2.58 feet) will allow 830,000 acre-feet of water to evaporate. About 1.2 million acre-feet will be returned to the lake through an overflow weir.

Assuming normal inflow to the lake and normal evaporation, the pumping project is expected to reduce the Great Salt Lake approximately 13 inches during the first year of pumping and 7 inches per year each succeeding year. Therefore, after 5 years the project will lower the lake nearly 4 feet over and above any drop in the lake level due to evaporation alone.



REV. 8-6-86 C.E. 41873, SHEET A-1

WEST DESERT PUMPING PROJECT

ORGANIZATION AND FACT SHEET

OWNER AND LEAD PUBLIC AGENCY
STATE OF UTAH
NATURAL RESOURCES
DIVISION OF WATER RESOURCES

LAKESIDE TO HOGUP EMBANKMENTS, ROAD, SLOPE PROTECTION

- DESIGNER - SP
- CONSTRUCTION MANAGER - SP
- PRIME SUBCONTRACTOR - LOST DUTCHMAN
- CONTRACTOR - SP
- QUANTITIES:
  - QUARRY RUN ROCK - 500,000 cy
  - UNDERLAYER STONE - 425,000 cy
  - SMALL UNDERLAYER STONE - 250,000 cy
  - BALLAST - 230,000 tons

HOGUP TO JACKSON EMBANKMENTS, ROAD, SLOPE PROTECTION

- DESIGNER - SP
- CONSTRUCTION MANAGER - SP
- PRIME SUBCONTRACTOR - LOST DUTCHMAN
- CONTRACTOR - SP
- QUANTITIES:
  - CANAL SPOIL - 380,000 cy
  - QUARRY RUN ROCK - 200,000 cy
  - 2 to 1 FOOT RIPRAP - 290,000 cy
  - BALLAST - 180,000 tons

WEST POND

NATURAL AREA - 500 sq. miles / 320,000 acres
AVERAGE DEPTH - 2.5 ft.
MAXIMUM DEPTH - 7 ft.
AVERAGE EVAPORATION PER YEAR - 30 to 36 in.

RAILROAD BRIDGES

- DESIGNER - SP / J.H. POMEROY
- CONSTRUCTION MANAGER - SP
- PRIME SUBCONTRACTOR - J.H. POMEROY
- SUBCONTRACTOR - LOST DUTCHMAN
- QUANTITIES:
  - 3 BRIDGES - 150 ft. span
  - 1 BRIDGE - 180 ft. span
  - 18 in. square concrete piles
  - PILES 70 to 80 feet long
  - Caps and girders all precast
  - GIRDER - 30 ft Coopers E-72

OUTLET CANAL

- DESIGNER - WEST DESERT GROUP ECKHOFF, WATSON, PREATOR
- CONSTRUCTION MANAGER - WDG / EWP
- CONTRACTOR - SP
- SUBCONTRACTOR - LOST DUTCHMAN
- LENGTH - 4.1 miles
- BOTTOM WIDTH - varies 35 to 90 feet
- DEPTH OF CUT - varies 10 to 65 feet
- TOTAL EXCAVATION - 3 million cy
- SLOPE - 0.15 ft. per 1000 ft

NEWFOUNDLAND DIKE

LENGTH: 8.1 miles
HEIGHT: 3 to 7 feet
VOLUME OF FILL: 249,000 cu. yds.
RIP-RAP: 85,000 cu. yds.
CONTROL WEIR: 1000 ft. long
CONTRACTOR: HERM HUGHES AND SONS, BOUNTIFUL, UT

PUMPS ENGINES GEAR DRIVE

- DESIGNER - WEST DESERT GROUP MORRISON-KNUDSEN ENGINEERS
- CONSTRUCTION MANAGER - WDG / MK ENGINEERS

PUMPS (3)
TYPE: Ingersoll-Rand vertical axis mixed flow
IMPELLER: 3 blades, 119 in. dia., 12,000 lbs.
SHAFT: 10.7 in. dia. 546 in. long (45.5 ft.), 18,750 lbs.
DISCHARGE ELBOW: 144 in. (12 ft.) dia.
TOTAL WEIGHT: 152,000 lbs.
MATERIAL: Aluminum bronze alloy
OPERATING SPEED: 139 rpm at 933 cfs (150 rpm max.)
PUMP LIFT: Variable 8 ft. to 22 ft.
MANUFACTURER: Ingersoll-Rand, Phillipsburg, NJ

GEAR DRIVE
WEIGHT: 36,000 lbs.
SPEED RATIO: 2.37
MANUFACTURER: Brad Foote Gear Inc., Cicero, NJ

ENGINES (3)
NOMINAL DIMENSIONS: 27 ft. 11 in. long, 11 ft. 10 in. wide, 17 ft. 10 in. high, 16 cylinder 3500 hp rating, 16.25 in. bore, 18 in. stroke
OPERATING SPEED: 330 rpm
WEIGHT: engine and skid, 162,800 lbs.
MANUFACTURER: Dresser-Rand, Painted Post, NY

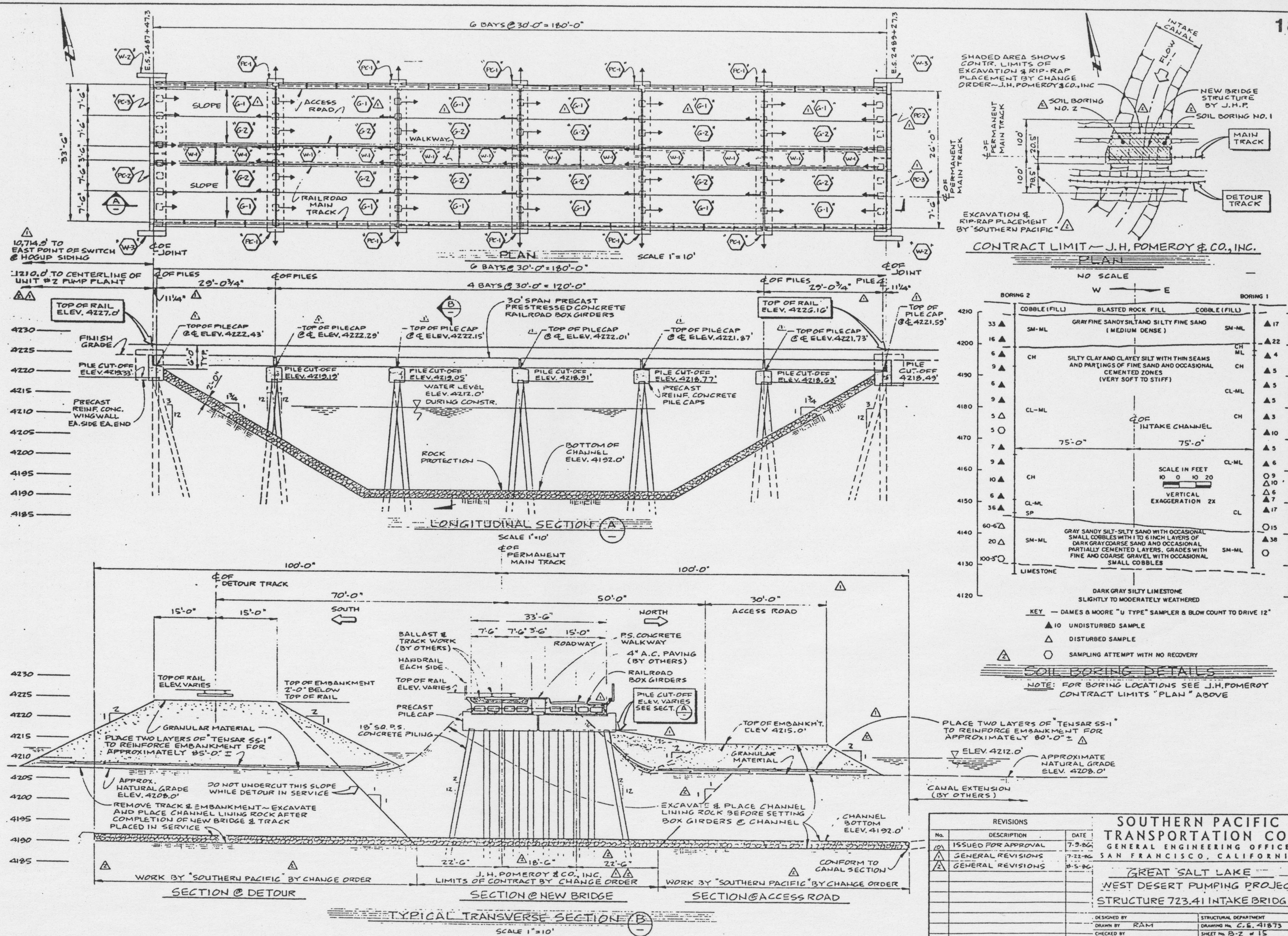
PUMPING RATE
ONE PUMP: 450,000 gpm (1,000 cfs)
TWO PUMPS: 900,000 gpm (2,000 cfs)
THREE PUMPS: 1,350,000 gpm (3,000 cfs)

PUMPING STATION
LENGTH: 110 feet
WIDTH: 55 feet
HEIGHT: 30 feet
BASE ELEVATION: 4230
CONSTRUCTION: Steel and reinforced concrete
CONTRACTOR: Layton Construction Company, Salt Lake City, UT

PUMP FOUNDATION
CONTRACTOR: SP / LOST DUTCHMAN

BONNEVILLE DIKE

LENGTH: 24.4 miles
HEIGHT: 3 to 6 feet
VOLUME OF FILL: 486,500 cu. yds.
RIP-RAP: 152,000 cu. yds.
CONTRACTOR: W.W. CLYDE CONSTRUCTION, SPRINGVILLE, UT

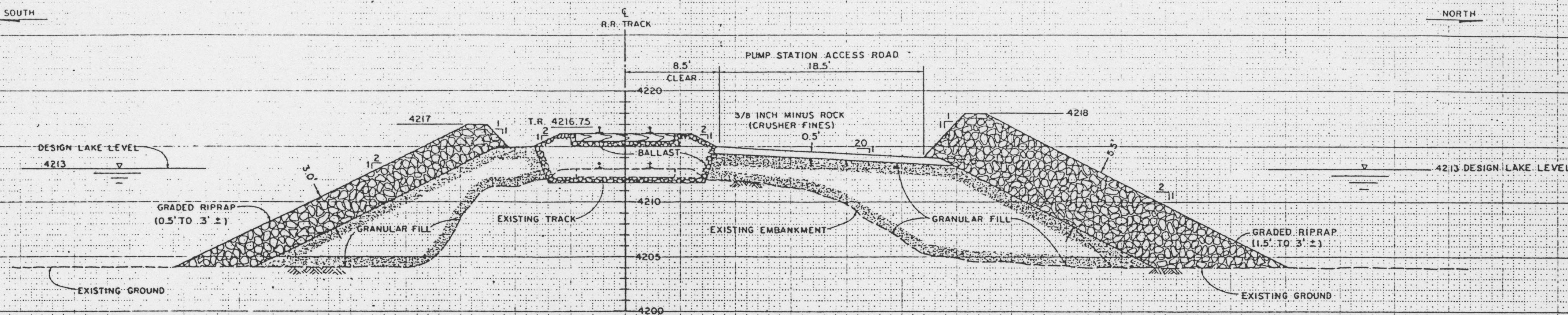


REVISIONS		
No.	DESCRIPTION	DATE
0	ISSUED FOR APPROVAL	7-3-86
1	GENERAL REVISIONS	7-22-86
2	GENERAL REVISIONS	8-5-86

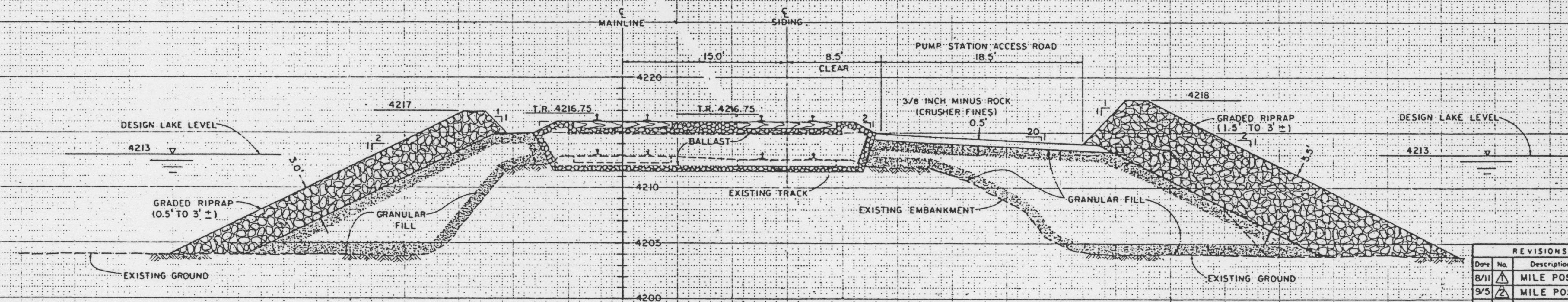
SOUTHERN PACIFIC TRANSPORTATION CO.
GENERAL ENGINEERING OFFICE
SAN FRANCISCO, CALIFORNIA

GREAT SALT LAKE
WEST DESERT PUMPING PROJECT
STRUCTURE 723.41 INTAKE BRIDGE

DESIGNED BY
DRAWN BY RAM
CHECKED BY
SCALE NOTED
DATE MAY 27, 1986
STRUCTURAL DEPARTMENT
DRAWING No. C.E. 41873
SHEET No. B-2 of 15
CASE DRAWER



TYPICAL SECTION SINGLE TRACK– E.S. 2510+00 (M.P. 723.8) TO E.S. 3045+00 (M.P. 733.96) *
PUMP STATION LAKESIDE



TYPICAL SECTION SINGLE TRACK & ONE SIDING – E.S. 2783+53 (M.P. 729.02 TO E.S. 2840+33 (M.P. 730.09) *
–STRONGKNOB SIDING–

REVISIONS		
Date	No.	Description
8/11	1	MILE POST
9/5	2	MILE POST

* SEE SHEETS 2 AND 3 FOR TYPICAL SECTIONS FROM E.S. 3020+91.84 (M.P. 733.5) TO E.S. 3047+94.16 (M.P. 734.0) LAKESIDE BRIDGE AND DETOUR TRACK

DESIGN CRITERIA

E.S. 2510+00 TO E.S. 3045+00

LOCATION	RETURN PERIOD YEARS	WATER SURFACE U.S.G.S.	WIND SET UP FT.	WAVE RUN UP FT.	WAVE HT. HS FT.	WAVE HT. H10 FT.	PROJECTED HIGHEST WATER U.S.G.S.	DESIGN HEIGHT R.R. EMBANKMENT U.S.G.S.	DESIGN HEIGHT ACCESS ROAD U.S.G.S.	DESIGN HEIGHT TOP OF RAIL U.S.G.S.	DESIGN WAVE FT.	DESIGN SLOPE	ROCK SLOPE WEIGHT & SIZE W50	ROCK SLOPE WEIGHT & SIZE WMAX	ROCK SLOPE WEIGHT & SIZE WMIN	ROCK SLOPE THICKNESS FT.	ROCK SLOPE DENSITY LB/FT²
NORTH SLOPE	10	4213	2.8	5.2		5.3	4221	4218 TOP OF BERM	4214.5 (AVG.)	4216.75	5.0	2H TO 1V	3,580 lbs. 3.2 FT.	14,320 lbs. 5.1 FT.	447 lbs. 1.6 FT.	5.5	520
NORTH SLOPE	10	4215	2.2	5.6		7.6	4222.8	4220 FUTURE TOP OF BERM	4218 FUTURE	4220.75 FUTURE	7.0						
SOUTH SLOPE	20	4213	2.5	1.7	1.7	2.3	4217	4217 TOP OF BERM			3.0	2H TO 1V	230 lbs. 1.3 FT.	920 lbs. 2.1 FT	28 lbs. 0.625 FT.	3.0	312
SOUTH SLOPE	10	4215	2.0	2.4	2.3	3.0	4219.4	4219 FUTURE TOP OF SLOPE			3.0						

SCALE IN FEET
5 0 5 10 15

Southern Pacific Transportation Company
General Engineering Office
Southern Pacific Building, One Market Plaza, San Francisco, California 94105

GREAT SALT LAKE

WEST DESERT PUMPING PROJECT
TYPICAL SECTIONS & ACCESS ROAD
LAKESIDE & STRONGKNOB EAST POND AREA

SCALE 1" = 5'	Engineering Department
VAL. SEC UTAH-1 SHEET 6-16	DRAWN BY W L C
ROUTE NO M.P. 694-735	CE DRAWING NO 41873
DATE MAY 20, 1986	SHEET NO 5
REVISED TO AUGUST 6, 1986	FILE DRAWER WDPP

DESIGN CRITERIA

GENERAL

PARAMETER	DESIGN VALUE
ENVIRONMENTAL CHARACTERISTICS	
DESIGN GSL WS LEVELS	4208 TO 4215
GSL SALT CONCENTRATIONS, G/L	
NORTH ARM	150
WIND SPEEDS - OVERLAND, MPH	
NORTHERLIES, 2 HOUR DURATION	
5 YEAR RETURN PERIOD	40.6
10 YEAR RETURN PERIOD	43.0
20 YEAR RETURN PERIOD	45.5
SOUTHERLIES, 2 HOUR DURATION	
5 YEAR RETURN PERIOD	41.1
10 YEAR RETURN PERIOD	43.7
20 YEAR RETURN PERIOD	46.2
DESIGN LIFE, YEARS	
PUMP PLANT, RETURN SIPHON, STRUCTURES	50
DIKES - WIND SPEED RETURN PERIOD	
PUMP PLANT ACCESS ROAD	10*
RAILROAD - EMBANKMENT-NORTH SLOPE (NIC)	10
RAILROAD - EMBANKMENT-SOUTH SLOPE (NIC)	10
*OVERTOPPING ANTICIPATED	
(NIC - NOT IN CONTRACT)	
SYSTEM OPERATION TIMEFRAME, YEARS.	10 TO 20

PUMPING SCENARIOS

PARAMETER	DESIGN VALUE
HIGH GSL OPERATING SCENARIO	
PUMPING RATES, CFS	
SUMMER-3 PUMPS (APRIL THRU OCT.)	2806
WINTER-1 PUMP (NOV. THRU MARCH)	933
AVERAGE	2022
ANNUAL AVERAGE EVAPORATION, MAF	1.0
WEST POND WS LEVEL FLUCTUATIONS	4217(JAN.) TO 4216.7(AUG.)
NEWFOUNDLAND WEIR FLOWS, CFS	957(NOV.) TO 109(AUG.)
GSL SALT CONCENTRATIONS, G/L	150

EVAPORATION PONDS (FIRST PHASE PROJECT)

PARAMETER	DESIGN VALUE
WEST POND	
DESIGN WATER SURFACE ELEVATION	4217
AREA, ACRES (APPROX.)	330,000
VOLUME, ACRE-FEET (APPROX.)	780,000
AVERAGE DEPTH, FEET (APPROX.)	2.3
LOWEST GROUND ELEVATION	4211

RAISED EMBANKMENTS

PARAMETER	DESIGN RETURN PERIOD, YEARS	WATER SURFACE ELEV.	WIND SET-UP ELEV.	WAVE RUN-UP	DESIGN TOP OF DIKE ELEV.
FIRST PHASE PROJECT					
LAKESIDE TO HOGUP					
RAILROAD EMBANKMENT (NIC)	5	4212	4214.6	4219.4	4215*
PUMP PLANT ACCESS ROAD (NIC)	5	4212	4214.6	4219.4	4215*
HOGUP-JACKSON	10	4217	4218.9	4220.2	4220.5
RAILROAD EMBANKMENT (NIC)	10	4217	4223.0	4224.2	4224.5
NORTH SLOPE					
SOUTH SLOPE					

(NIC - NOT IN CONTRACT)

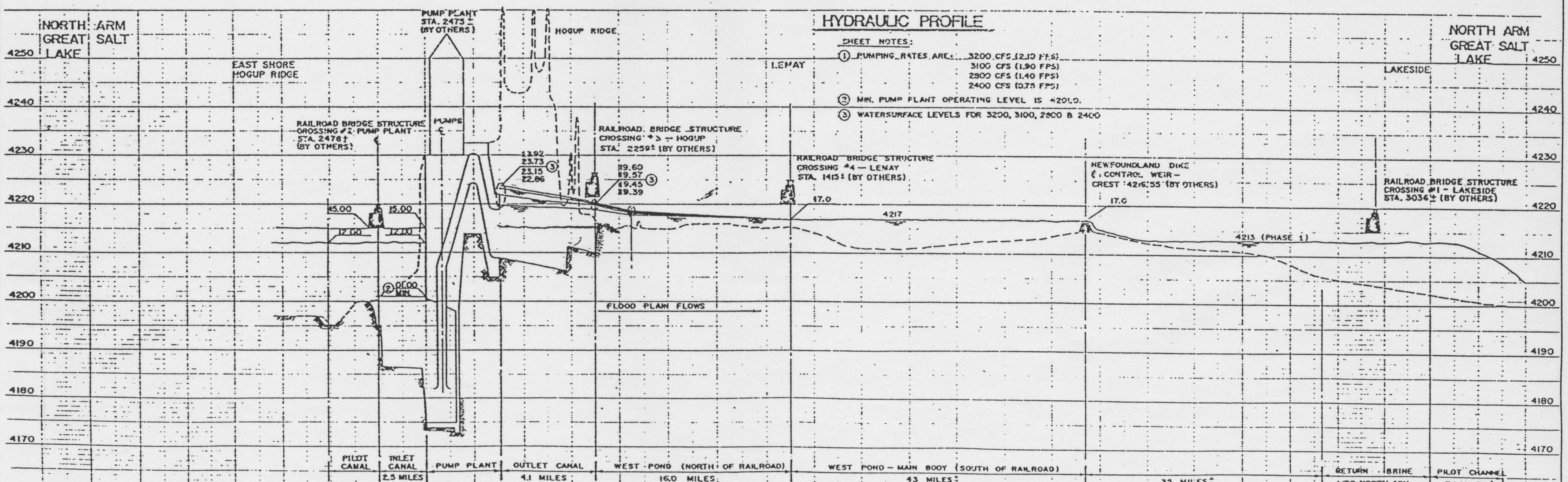
PUMP PLANT

PARAMETER	DESIGN VALUE
PUMPING UNITS	
TYPE OF PUMPS	VERTICAL TURBINE
FLOW TYPE	AXIAL OR MIXED
NUMBER OF UNITS	3
CAPACITY, CFS/UNIT	933
TOTAL DESIGN HEAD, FEET	25
TYPE OF ENGINE	INTERNAL COMBUSTION
FUEL TYPE	NATURAL GAS
MAXIMUM ENGINE HORSEPOWER	3440
PUMP MATERIAL	ALUMINUM BRONZE
ENVIRONMENTAL CHARACTERISTICS	
FOREBAY WS LEVELS	
MAXIMUM ELEVATION	4215
MINIMUM ELEVATION	4201
AFTERBAY WS LEVELS	
MAXIMUM ELEVATION	4224
BRINE SPECIFIC GRAVITY	1.1
MAX. BRINE TEMPERATURE, °F	90
AMBIENT TEMP. RANGE, °F	-20 TO 130
PUMP PLANT	
FLOOR ELEVATION	4230
SUMP FLOOR ELEVATION	4175
PUMP HOUSE FLOOR AREA, SF	8050
SERVICE BUILDING FLOOR AREA, SF	2736

CANAL

PARAMETER	DESIGN VALUE
OUTLET CANAL	
BOTTOM WIDTH, FEET	
SANDS, CONGLOMERATES	35
CLAYS, EAST AND WEST SECTIONS	35 & 90
LIMESTONES	45
SIDE SLOPES, HORIZ. TO VERT.	
SANDS, CONGLOMERATES, CLAYS	2.5:1
LIMESTONES	VERTICAL
MANNINGS 'N' COEFFICIENT	
SANDS, CONGLOMERATES	0.025
CLAYS	0.028
LIMESTONE	0.040
FLOOD PLAINS IN WEST POND AREA	0.030
MAXIMUM NON-ERODABLE VELOCITY, FPS	
SANDS, CONGLOMERATES, CLAYS	3.0
LIMESTONES	4.0
MAXIMUM DESIGN VELOCITY, FPS	2.8
DESIGN VELOCITIES, FPS	SEE HYDRAULIC PROFILE

HYDRAULIC PROFILE



Designed By	E.G.T., K.K.N.
Drawn By	G.A.B.
Checked By	E.G.T. 12/85
Recommended	
Approved By	Date

No | Revision | By | Date | Chk. | App'd

Date

WEST DESERT GROUP

ECKHOFF, WATSON & PREATOR ENGINEERING
1121 E. 3900 SO. PARKVIEW BLDG. C. SUITE 100
SALT LAKE CITY, UTAH 84124

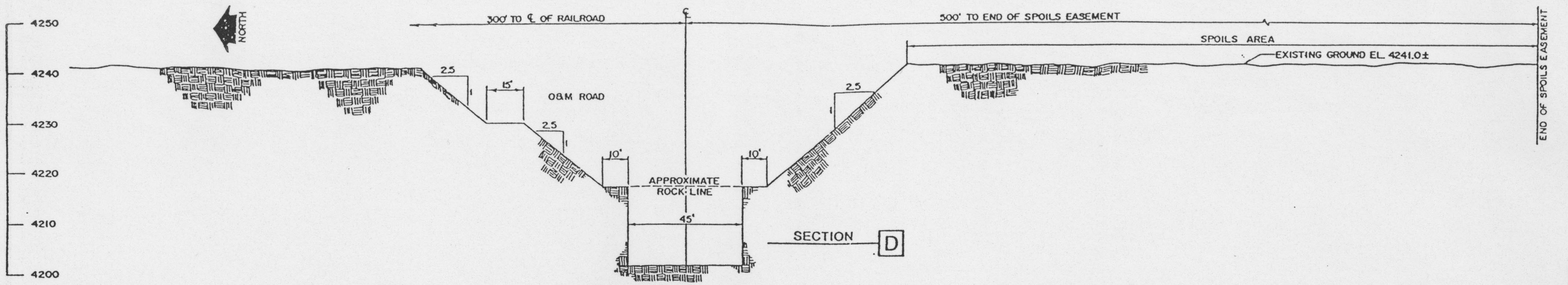
MORRISON-KNUDSEN ENGINEERS, INC.
180 HOWARD STREET,
SAN FRANCISCO, CALIFORNIA 94106

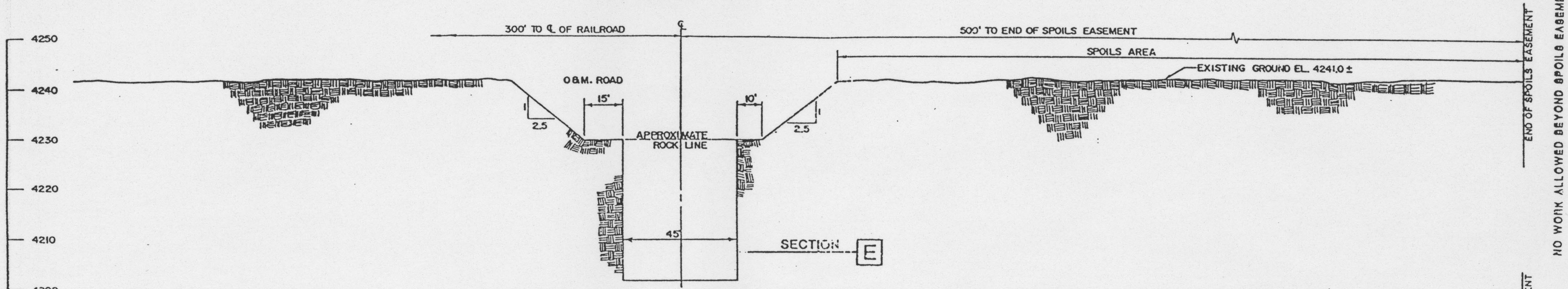
STATE OF UTAH
DIVISION OF WATER RESOURCES
SALT LAKE CITY, UTAH

WEST DESERT PUMPING PROJECT
GREAT SALT LAKE

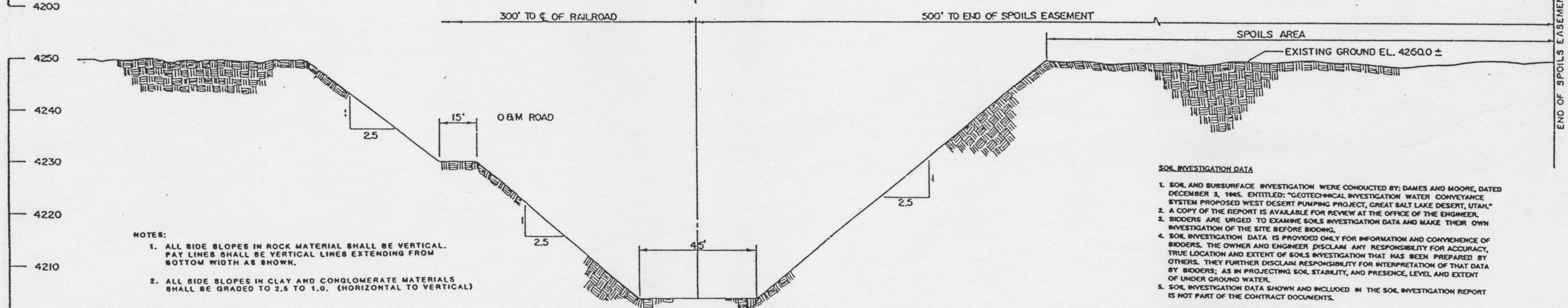
DESIGN CRITERIA
& HYDRAULIC PROFILE

Proj. No. EU19-04-01
Sheet G 4 | 01 | Rev.





NO WORK ALLOWED BEYOND SPOILS EASEMENT



NOTES:

1. ALL SIDE SLOPES IN ROCK MATERIAL SHALL BE VERTICAL. PAY LINES SHALL BE VERTICAL LINES EXTENDING FROM BOTTOM WIDTH AS SHOWN.
2. ALL SIDE SLOPES IN CLAY AND CONGLOMERATE MATERIALS SHALL BE GRADED TO 2.5 TO 1.0. (HORIZONTAL TO VERTICAL)

SECTION F

SCALE: HORIZON.-1"=20'
VERT.-1"=10'

SOIL INVESTIGATION DATA

1. SOIL AND SUBSURFACE INVESTIGATION WERE CONDUCTED BY: DAMES AND MOORE, DATED DECEMBER 3, 1985. ENTITLED: "GEOTECHNICAL INVESTIGATION WATER CONVEYANCE SYSTEM PROPOSED WEST DESERT PUMPING PROJECT, GREAT SALT LAKE DESERT, UTAH."
2. A COPY OF THE REPORT IS AVAILABLE FOR REVIEW AT THE OFFICE OF THE ENGINEER.
3. BIDDERS ARE URGED TO EXAMINE SOILS INVESTIGATION DATA AND MAKE THEIR OWN INVESTIGATION OF THE SITE BEFORE BIDDING.
4. SOIL INVESTIGATION DATA IS PROVIDED ONLY FOR INFORMATION AND CONVIENENCE OF BIDDERS. THE OWNER AND ENGINEER DISCLAIM ANY RESPONSIBILITY FOR ACCURACY, TRUE LOCATION AND EXTENT OF SOILS INVESTIGATION THAT HAS BEEN PREPARED BY OTHERS. THEY FURTHER DISCLAIM RESPONSIBILITY FOR INTERPRETATION OF THAT DATA BY BIDDERS; AS IN PROJECTING SOIL STABILITY, AND PRESENCE, LEVEL AND EXTENT OF UNDER GROUND WATER.
5. SOIL INVESTIGATION DATA SHOWN AND INCLUDED IN THE SOIL INVESTIGATION REPORT IS NOT PART OF THE CONTRACT DOCUMENTS.

FINAL GRADING NOTES:

AREAS OF NO VEGETATION

1. STOCKPILING OF TOPSOIL SHALL NOT BE REQUIRED.
2. SPOIL MATERIALS SHALL BE GRADED TO BLEND IN WITH THE NATURAL CONTOURS OF THE GROUND AS REQUIRED BY THE SPECIFICATIONS.
3. STOCKPILED TOPSOIL SHALL BE SPREAD TO A UNIFORM 6 INCH LAYER UPON THE GRADED SPOIL MATERIAL.
4. AREA SHALL BE RE-SEEDED AS REQUIRED BY THE SPECIFICATIONS.

OUTLET CANAL TYPICAL SECTIONS

Date

No.	Revision	By	Date	Chk.	App'd

Designed By E.G.T., K.K.N., R.K.G.
Drawn By L.A.R.
Checked By KKN
Recommended
Approved By ______ Date ______

WEST DESERT GROUP

ECKHOFF, WATSON & PREATOR ENGINEERING
1121 E. 3900 SO. PARKVIEW BLDG. C, SUITE 100
SALT LAKE CITY, UTAH 84124

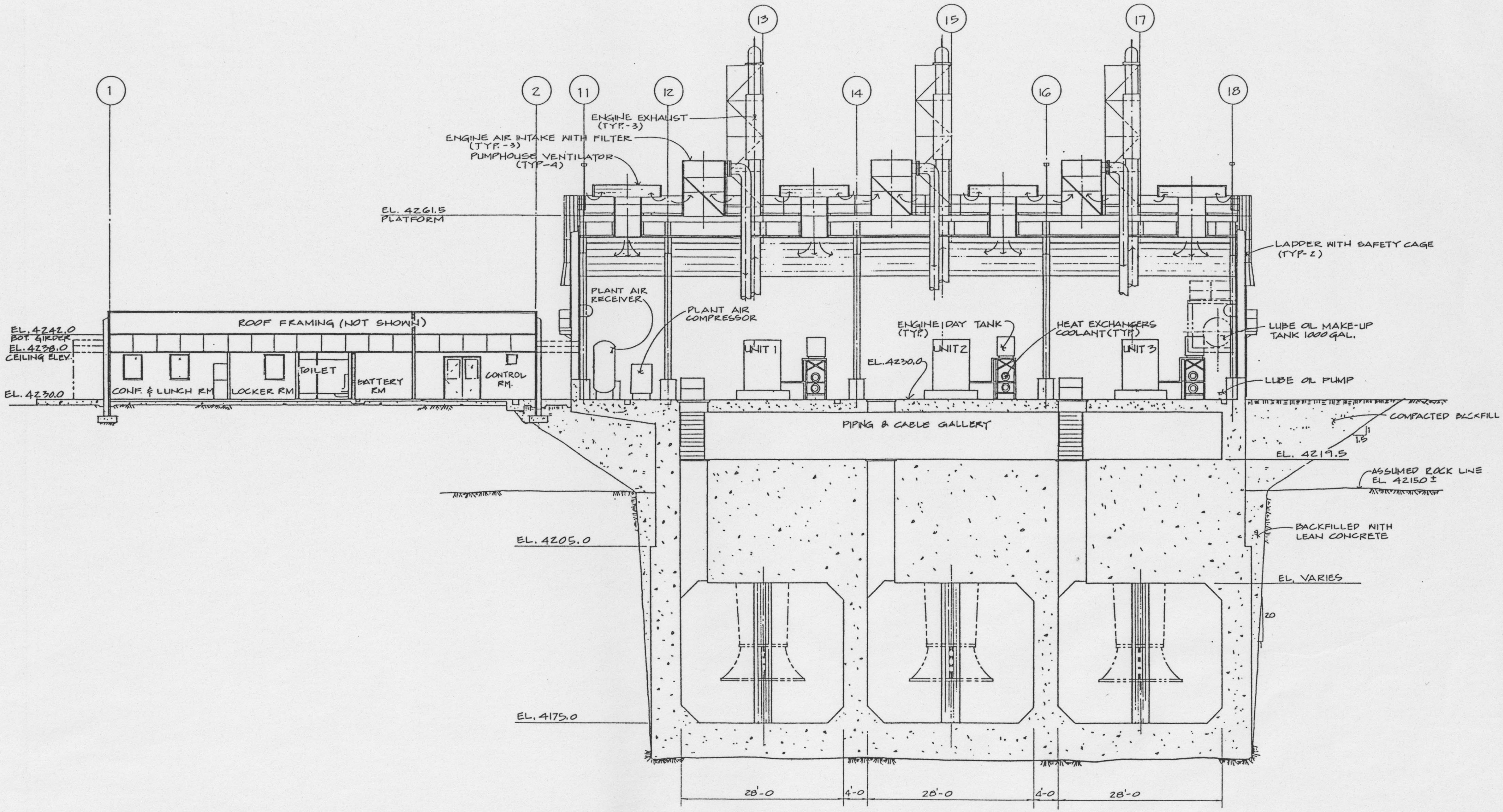
MORRISON-KNUDSEN ENGINEERS, INC.
180 HOWARD STREET,
SAN FRANCISCO, CALIFORNIA 94106

STATE OF UTAH
DIVISION OF WATER RESOURCES
SALT LAKE CITY, UTAH

WEST DESERT PUMPING PROJECT
GREAT SALT LAKE

TYPICAL EARTHWORK SECTIONS

Proj. No. EU19-04-01
Sheet G6-B
Ctl/Rev. 2



SECTION (A) PPC07 — (A) PPC-08
SCALE: 1/8" = 1'-0

5 0 5 10 15 20
SCALE 1/8" = 1' FEET

THIS PRINT REDUCED

No	Revision	By	Date	Chk.	App'd.

Date

Designed By SSH
Drawn By JOC
Checked By WOC
Recommended
Approved By Date 5 DEC 85

WEST DESERT GROUP

ECKHOFF, WATSON & PREATOR ENGINEERING
1121 E. 3900 SO. PARKVIEW BLDG. C, SUITE 100
SALT LAKE CITY, UTAH 84124

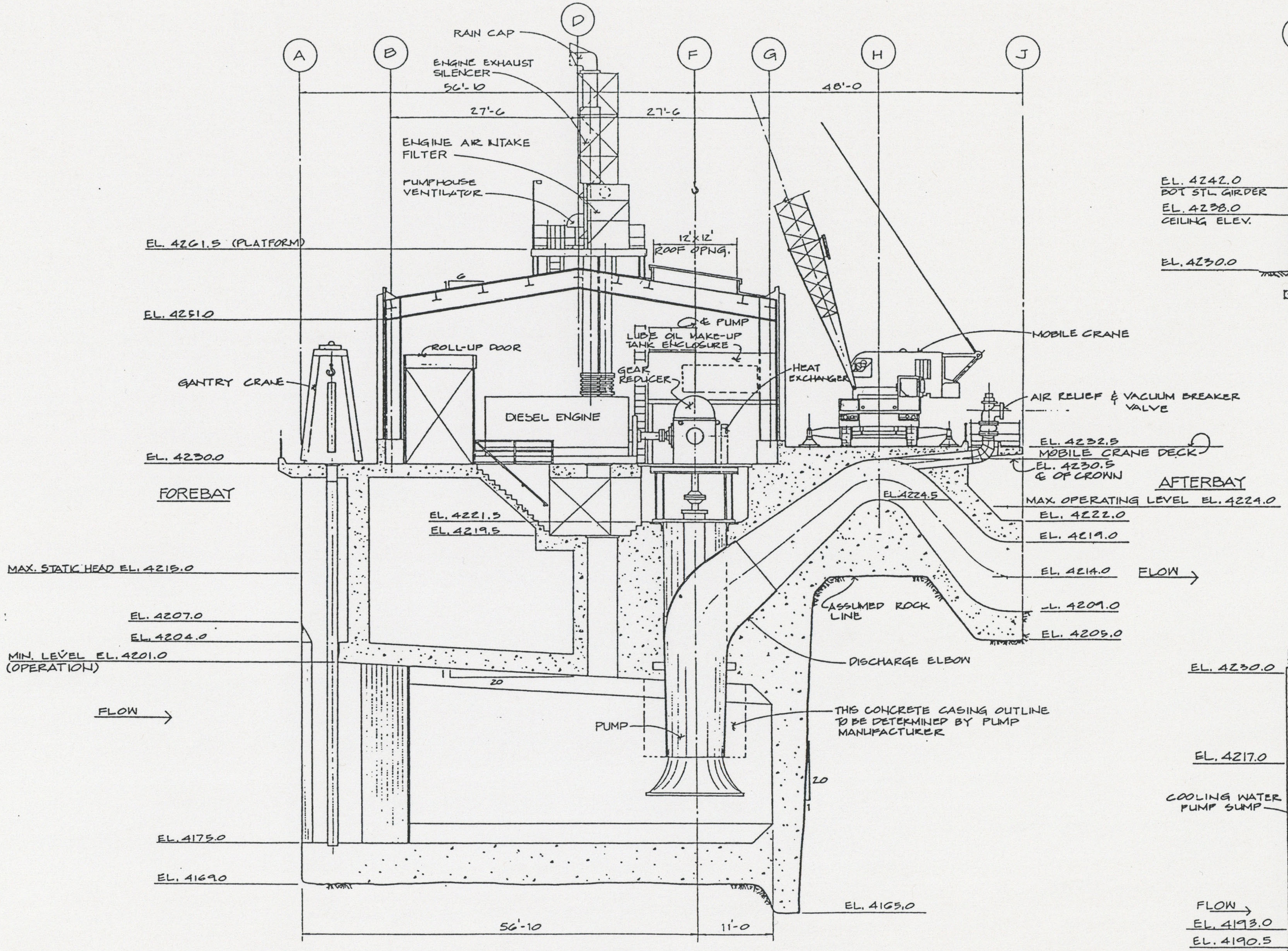
MORRISON-KNUDSEN ENGINEERS, INC.
180 HOWARD STREET,
SAN FRANCISCO, CALIFORNIA 94105

STATE OF UTAH
DIVISION OF WATER RESOURCES
SALT LAKE CITY, UTAH

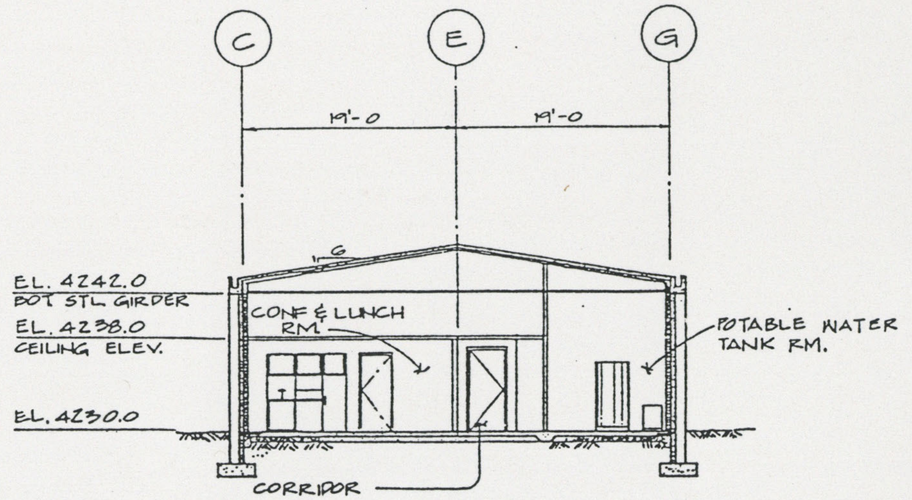
WEST DESERT PUMPING PROJECT
GREAT SALT LAKE

GENERAL ARRANGEMENT
LONGITUDINAL SECTION

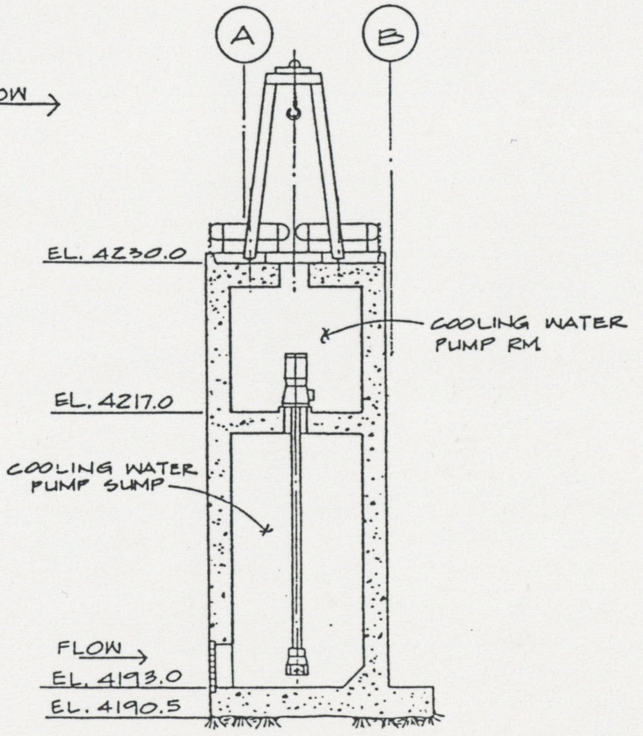
Proj. No. EU19-04-01
Sheet Of Rev.
PPC-09-1



SECTION B
SCALE: 1/8" = 1'-0 PPC 07-1 B PPC-08



SECTION C
SCALE: 1/8" = 1'-0 PPC 07-1



SECTION D
SCALE: 1/8" = 1'-0 PPC 07-1

SCALE 1/8" = 1' — 5 0 5 10 15 20 FEET

THIS PRINT REDUCED

No	Revision	By	Date	Chk.	App'd.

Date

Designed By SSH
Drawn By [illegible]
Checked By WOC
Recommended [illegible]
Approved By [illegible] Date 3 DEC 85

WEST DESERT GROUP

ECKHOFF, WATSON & PREATOR ENGINEERING
1121 E. 3900 SO. PARKVIEW BLDG. C, SUITE 100
SALT LAKE CITY, UTAH 84124

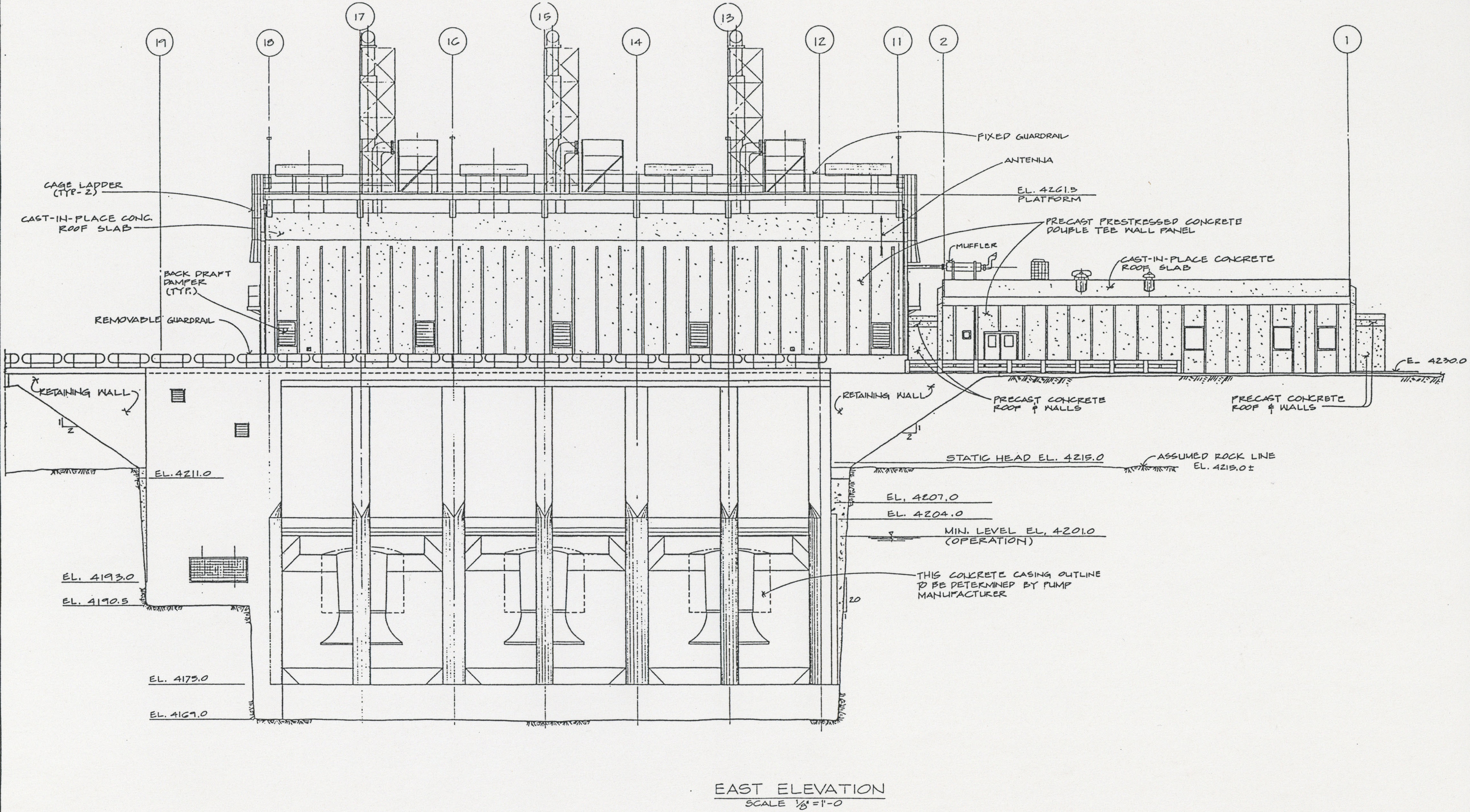
MORRISON-KNUDSEN ENGINEERS, INC.
180 HOWARD STREET,
SAN FRANCISCO, CALIFORNIA 94105

STATE OF UTAH
DIVISION OF WATER RESOURCES
SALT LAKE CITY, UTAH

WEST DESERT PUMPING PROJECT
GREAT SALT LAKE

GENERAL ARRANGEMENT
TRANSVERSE SECTIONS

Proj. No. EU19-04-01
Sheet
01 Rev.
PPC-10-1



EAST ELEVATION
SCALE 1/8"=1'-0

5 0 5 10 15 20
SCALE 1/8"=1' FEET

THIS PRINT REDUCED

Designed By	SSH
Drawn By	[illegible]
Checked By	WOC
Recommended	[illegible]
Approved By	[illegible] Date 3 Dec 85

Date

No. | Revision | By | Date | Chk. | App'd.

WEST DESERT GROUP

ECKHOFF, WATSON & PREATOR ENGINEERING
1121 E. 3900 SO. PARKVIEW BLDG. C, SUITE 100
SALT LAKE CITY, UTAH 84124

MORRISON-KNUDSEN ENGINEERS, INC.
180 HOWARD STREET,
SAN FRANCISCO, CALIFORNIA 94105

STATE OF UTAH
DIVISION OF WATER RESOURCES
SALT LAKE CITY, UTAH

WEST DESERT PUMPING PROJECT
GREAT SALT LAKE

GENERAL ARRANGEMENT
ELEVATION - EAST

Proj. No. EU15-04-01

Sheet | Of | Rev.

PPC-11

THANKS FOR TAKING THE TIME TO VISIT OUR RAILROAD

HAVE A SAFE TRIP HOME

SOUTHERN
LINES
PACIFIC

ECKHOFF, WATSON AND PREATOR ENGINEERING

WEST DESERT PUMPING PROJECT

FIRST PHASE (BARE BONES) ALTERNATIVE