

1. Considered 1-26, 1940 Appl. No. 563-2
2. Name of Applicant Dakota West Corporation
3. Post Office Address Huron
4. Amount of water claimed .668
5. Source of water supply Iron Creek
6. Water to be used for Commercial - Resort - Landscaping
Acres to be irrigated 22 Golf Course
7. Water to be diverted and used in Cluster County about
 miles of
8. Proof of Publication Received ☒
Not Received
9. Application Approved ☒
Subject to
Not approved
Action deferred

10. Remarks:

Storage of non-irrigation purpose
Illinois

No. 563-2Water Division No. 2Butte Creek
(Blanks to be filled by the Engineer for the W. R. C.)

District

DEC 1 1959
10:30 A.M.STATE WATER RESOURCES BOARD
PIERRE, SOUTH DAKOTAAPPLICATION FOR PERMIT
To Appropriate Water within the State of South Dakota

(NOTE—Draw a line through item as not applicable.)

1. Name of applicant U.S. Forest Service
P.O. Box 742
 Postoffice address 265 5th St., Huron, S. Dak.
Huron County Huron State South Dakota

I. If a corporation

- (a) Name of same Dakota West Corporation
 (b) Date and place of incorporation 1951 Huron, South Dakota
 (c) Amount of capital stock \$250,000.00
 (d) Amount paid in \$125,000.00
 (e) Names and addresses of directors

Robert D. Lusk, 265 5th St., S.E., Huron, S. Dak.Jeannette C. Lusk, 265 5th St., S.E., Huron, S. Dak.A. J. Popovich, 1863 Wisconsin Ave., S.W., Huron, S. Dak.

(NOTE—A certified copy of articles of incorporation must accompany the application.)

II. Method of accomplishing the work and financial resources of the applicant:

- (a) Method of accomplishing work (Whether by contract, employment of others, or by direct labor)

contract work(b) Cash on hand, \$ 5,199.67Treasury stock, \$ none(d) Bonds to be issued, \$ none(e) Other resources, \$ adequate

2. Name of diversion work Mount Rushmore Resort Diversion Works
 3. Amount of water claimed 300 GPM or 0.668 cubic feet per second at maximum pumping rate
Estimated 117 Acre Feet per year.
 4. Source of water supply Iron Creek
 5. Location of point of diversion 1177 feet S43°05'E from the NW corner of Section 27,
T2S, R6E, BHM by a dam on both banks Custer County.
 6. Annual period or periods during which water is to be used Nine months resort operation,
year-round for maintenance staff
 7. To be used for:

I. Irrigation or domestic use: Gravity, overhead sprinkling or combination system Sprinkler, 18 weeks(a) Number of acres to be irrigated 22 acres.(b) Legal subdivisions to be irrigated Golf greens & tees and landscaped grounds(NOTE—A list of lands to be irrigated, giving each subdivision and fraction with acreage thereof, should be written here, or may be appended as a part of this application. Same must also be shown on accompanying map.) located in SW $\frac{1}{4}$ and NW $\frac{1}{4}$ SE $\frac{1}{4}$ Sec. 27, T2S, R6E, BHM

(c) Statement as to domestic use (giving location, etc.)

II. Stockwatering, mining, milling, power, fish culture, fire protection and public recreation:

- (a) Nature of use Human consumption & general use, including firepro-
tection at recreational resort located in SW $\frac{1}{4}$ and NW $\frac{1}{4}$ SE $\frac{1}{4}$
 Name any of the above uses claimed Sec. 27, T2S, R6E, BHM

(b) Amount of power to be generated horse power.

Amount claimed for engine cooling

(c) Location of plant

(d) Method of developing power

(e) Point where water will be returned to stream

Map No 535-2

8. Estimated cost of work: See "Estimated Cost of Work" on back of this form.
- (a) Head Gates, \$----- (b) Pumping plant, \$-----
(c) Fluming, \$----- (d) Canal-earth, \$----- Rock, \$-----
(e) Other structures \$----- Total, \$-----

9. Description of diversion works:

I. Nature of works: (Reservoir, dam, ditch, flume, pumping plant, etc.)

Dam and reservoir with pumping plant

II. Dimensions of works:

- (a) Dam: Height (MAX.) 11 feet; length at bottom 6' (in channel) feet; length at top 10 feet; thickness at bottom 305 feet; thickness at top 12 feet; slope at front water face 3:1 (Freeboard) 4 feet; slope at back face 3:1 with 20' berm material used in construction compacted earth fill
- (b) Reservoir: Capacity when filled 115.2 acre feet. Surface area at highwater mark 10.9 acres.

DEPTH AT OUTLET-Feet	SURFACE AREA AT EACH DEPTH AT OUTLET--ACRES	ACRE-Feet CAPACITY

STATE OF SOUTH DAKOTA)

COUNTY OF BEADLE) ss

Robert D. Lusk, being first duly sworn on his oath, deposes and says that he is the President of Dakota West Corporation, the Corporation that is described above and the owner of the above described property; that he has read the above and foregoing statement, examined the map accompanying the same, and that he knows of his own personal knowledge that the matters therein stated and shown are true.

Signed [Signature]

Subscribed and sworn to before me this 30th day of November, 1959.

William S. Churchill
William S. Churchill Notary Public
My Commission Expires July 5, 1966

(Give dimensions where reductions in size are made.)

10. Time required for completion of work 3 years.
11. Time required for complete application of water to the proposed beneficial use 3 years.
12. Choice of newspaper for publication of notice of intention to appropriate Custer County
Chronicle, Custer, S.D., Gate City Guide, Rapid City, S.D.

STATE OF SOUTH DAKOTA

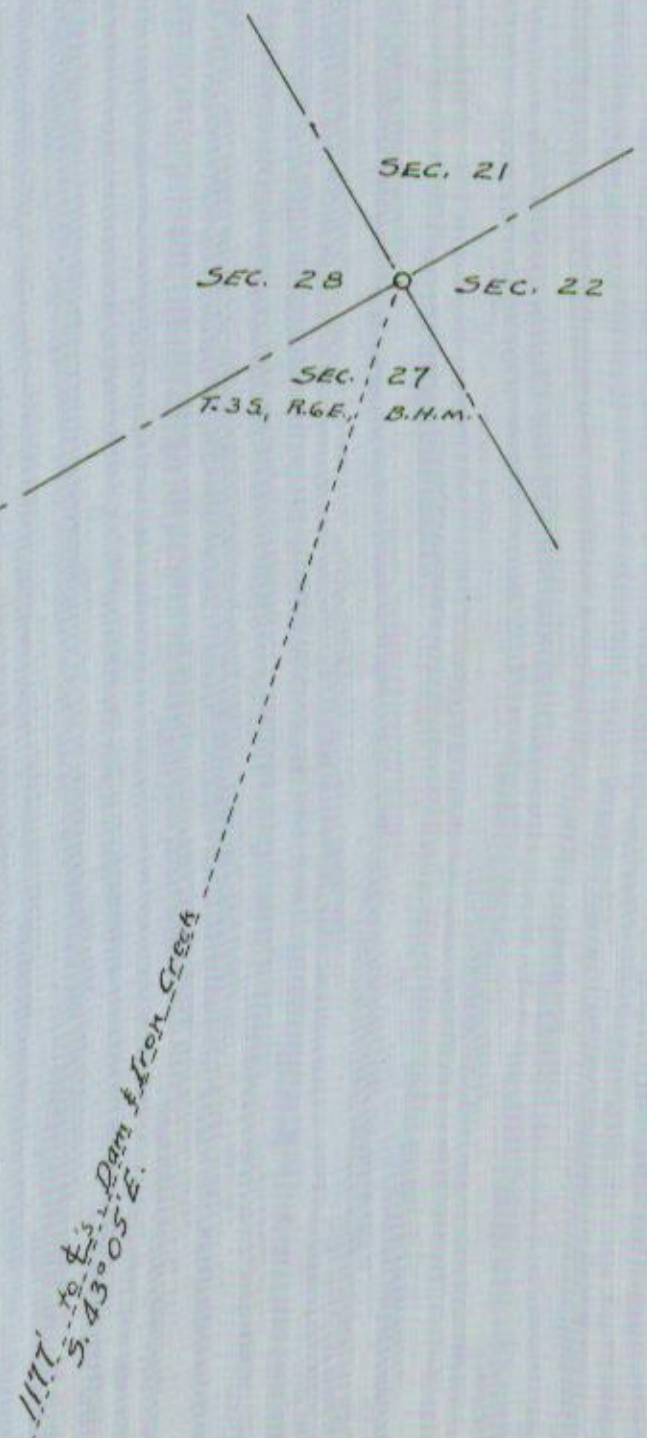
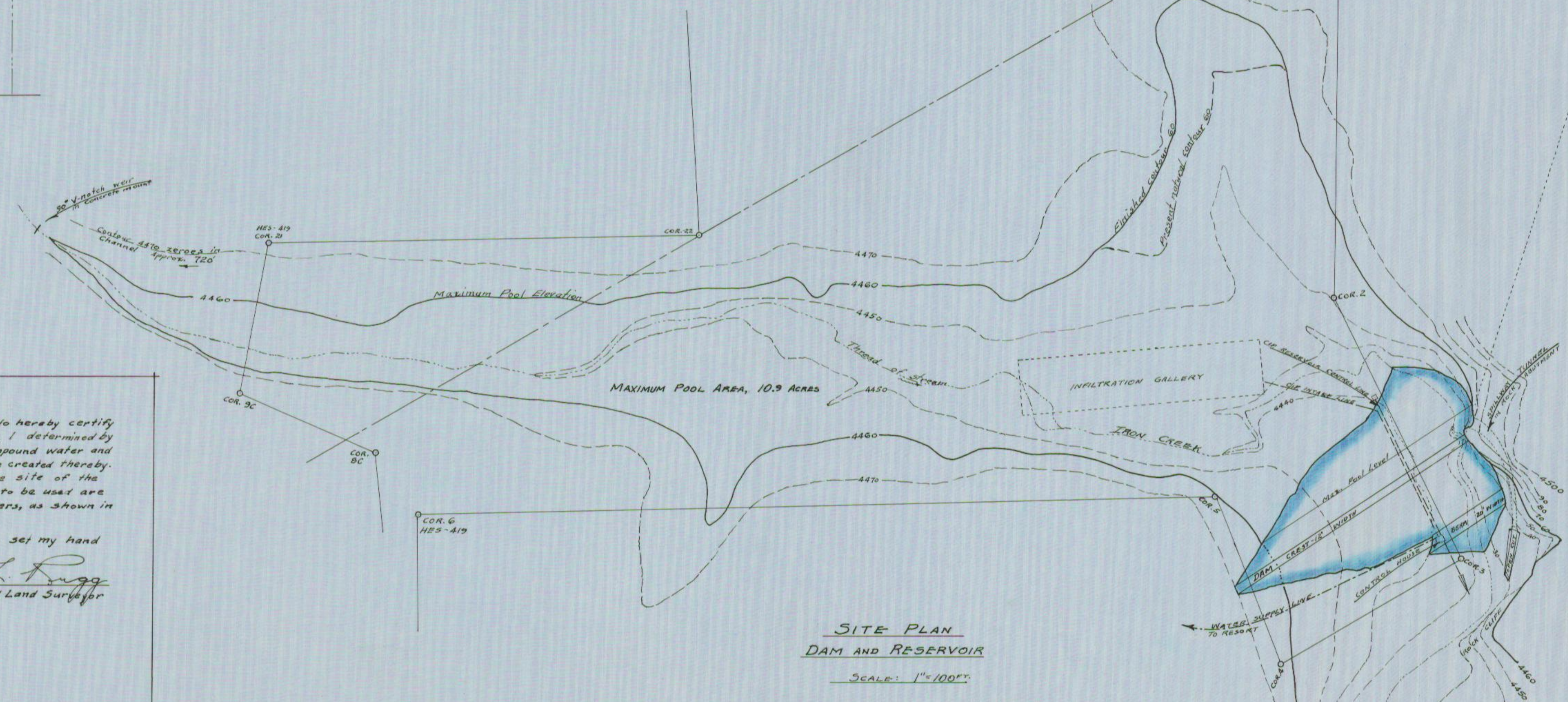
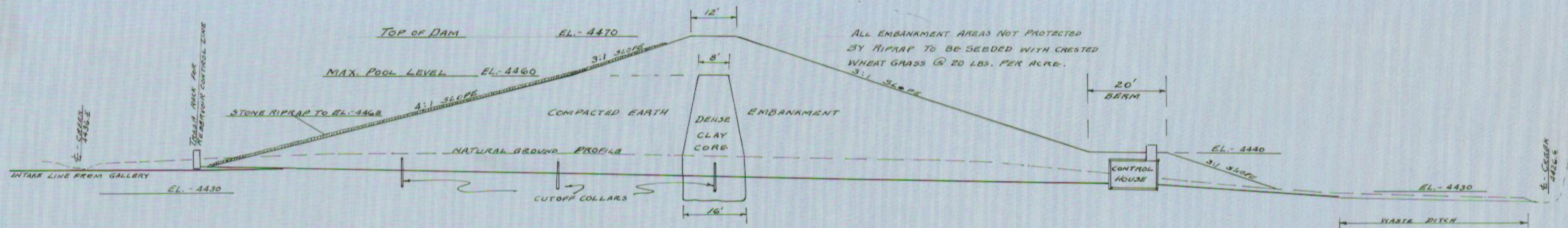
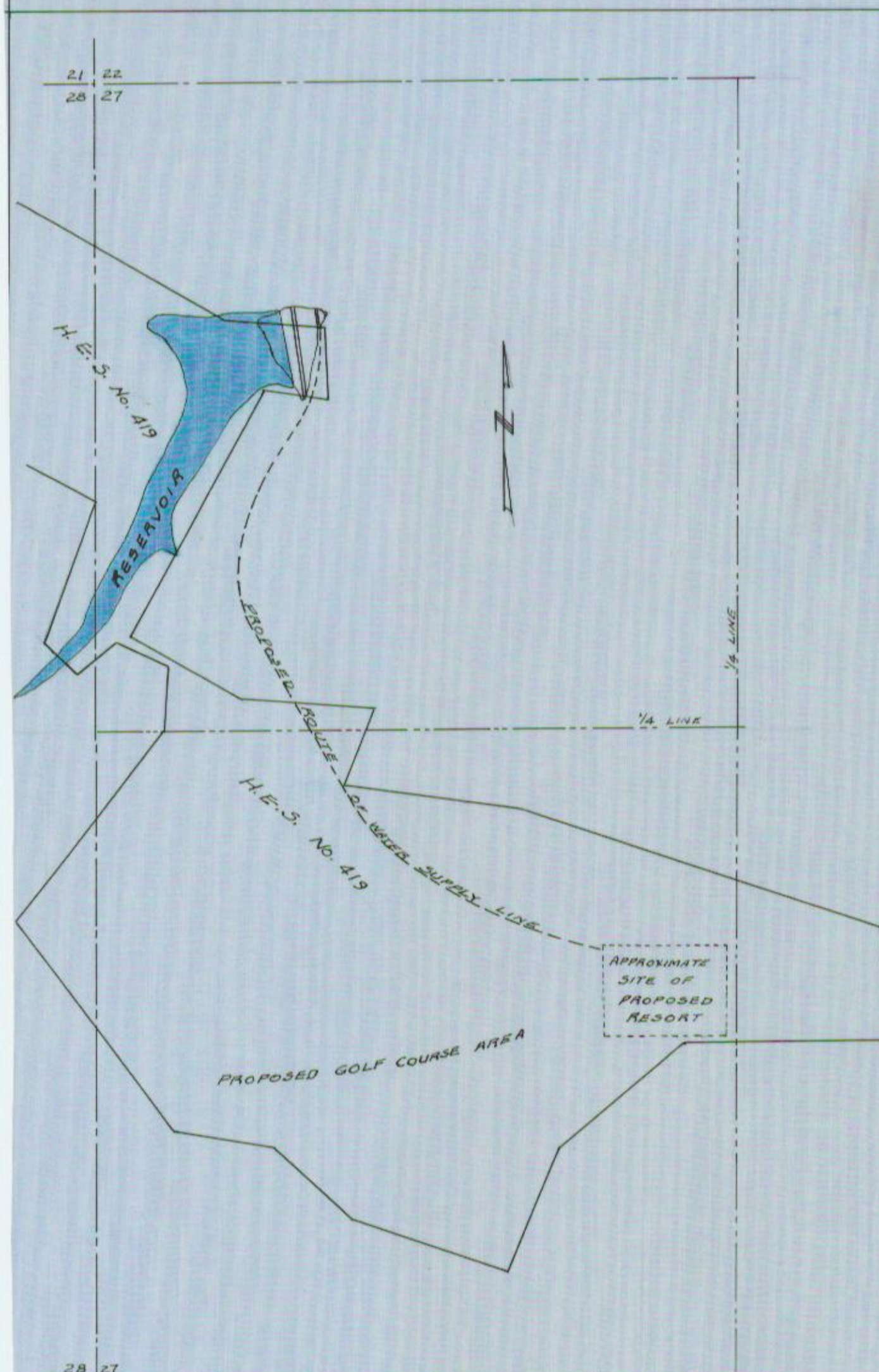
County of ----- } ss.

I, -----, being first duly sworn on my oath depose and say: That my relation to the above described undertaking is that of owner, that I have read the above foregoing statement, examined the map accompanying the same, and that I know of my own personal knowledge that the matters therein stated and shown are true.

Signed -----

Subscribed and sworn to before me this ----- day of ----- 19-----

Notary Public (or other qualified officer.)



SURVEYORS CERTIFICATE

I, V.L. Rugg, a Registered Land Surveyor, do hereby certify that, at the request of the DAKOTA WEST CORPORATION, I determined by field survey the location of a proposed dam to impound water and the shape, location and capacity of the reservoir to be created thereby. I further certify that the point of diversion, the site of the reservoir and the proposed areas where water is to be used are located, with reference to U.S. Land Survey corners, as shown in the above map.

IN WITNESS WHEREOF, I have hereunto set my hand and seal this 13th day of November, 1959.

V.L. Rugg
Registered Land Surveyor

ACKNOWLEDGMENT OF SURVEYOR

STATE OF SOUTH DAKOTA
COUNTY OF PENNINGTON ss

ON THIS DAY, before me, the undersigned, a Notary Public within and for the State and County aforesaid, personally appeared V.L. Rugg, known to me to be the person who executed the above Surveyors Certificate and acknowledged to me that he executed the same.

WITNESS my hand and seal this 13 day of November, 1959.

Walter P. Evers
Notary Public

My commission expires Aug 16, 1965

MAP OF WATER DIVERSION FACILITIES
IN SECS. 27 AND 28, T.2S., R.6E., B.H.M.
TO ACCOMPANY APPLICATION FOR PERMIT TO APPROPRIATE WATER
SCALE: AS SHOWN

PREPARED FOR: DAKOTA WEST CORPORATION
HURON, SOUTH DAKOTA

BY: STAVEN ENGINEERING Co.
RAPID CITY, SOUTH DAKOTA

Map No 535-2 (App'l No 535-2) Nov. 1959

Remarks by State Water Resources Commission:

Unappropriated waters at this location are limited to non-irrigation season stream flows. This Permit is limited to storage of such non-irrigation season waters. Once stored the water may be used throughout the year. During irrigation season, passage of flows into the reservoir may be required through the dam in the amount of the rate of inflow in order to satisfy downstream domestic use water rights and prior appropriative water rights.

STATE OF SOUTH DAKOTA

County of Hughes } ss.

Pierre, South Dakota, February 1, 1960

This is to certify that the foregoing application was received by the Commission at 10:30 o'clock A.m. upon the 1st day of December, 1959.

State Water Resources Commission

By: J. W. Rimmer
Chief Engineer, Executive Officer

Number of permit 563-2

Date of first receipt of application December 1, 1959

Date of return to applicant for correction, amendments or changes required as follows: December 1, 1959

Date of receipt of corrected application December 3, 1959

Date from which applicant may claim right December 1, 1959

Approved January 26, 1960, Recorded in Book 5 Page 310

This is to certify that we have examined the foregoing application for a permit to appropriate water of the State of South Dakota, and we hereby grant the same as stated herein, subject, however, to the following limitations and conditions:

1st. The equivalent of at least one-fifth of the work above specified is to be completed on or before

July 26, 1962

2nd. The whole of said work is to be completed on or before

April 6, 1965
January 26, 1962

3rd. The limit of time for proof of beneficial use of water appropriated in accordance herewith is

January 26, 1966

4th. The water appropriated shall be used for the purpose of operation of commercial resort & irrigation for landscaping & golf greens

5th. The prior right of all persons who, by compliance with the laws of the State of South Dakota, have acquired a right to the use of water must not be injuriously affected by this appropriation.

6th. The amount of the appropriation herein granted shall not exceed .66 cubic feet per second; neither shall it exceed the capacity of the above described system of diversion works, nor the least amount of water that experience may hereafter indicate as necessary for the production of crops in the event of the loss of husbandry; and further, said appropriation must be limited to not more than one-twentieth (1/20) of one cubic foot of water per acre of land to which water is actually and beneficially applied for the purposes above mentioned January 26, 1966; said water to be used during the following described annual period:

Nine months resort operation year round for maintenance staff & drainage

Witness my hand this 1st day of February, 1960.

State Water Resources Commission

By: J. W. Rimmer
Chief Engineer, Executive Officer

Certificate of Construction Issued July 8, 1970

Water License Issued July 8, 1970

Remarks by the Applicant:

ITEM 8: Estimated Cost of Work

Dam and accessories (spillway, control house)	\$40,214.00
Intake and reservoir control pipe lines	5,328.00
Valves, meter, weir	1,085.00
Infiltration gallery	4,300.00
	<u>\$50,927.00</u>
Contingencies, @ 10%	5,093.00
ESTIMATED STORAGE COST	<u>\$56,020.00</u>

Water Supply Line: Pumps	\$ 1,800.00	
Supply pipe line to approximate location	<u>12,800.00</u>	
		<u>14,600.00</u>
TOTAL		\$70,620.00

APPENDED: Two prints of reservoir curves showing reservoir capacity and area and spillway discharge rate at varying water stages.

REFERENCE: Engineer's Report on Preliminary Survey, Design and Cost Estimate, dated October 31, 1959.

STATE OF SOUTH DAKOTA

WATER LICENSE NO. 563-2

(1) WHEREAS, On the 1st day of December A. D. 19 59
Dakota West Corporation

made Water Right Application No. 563-2 for a permit to use .66 cubic feet per second of the water
of Iron Creek, including storage of 115.2 acre feet of water
County of Custer, State of South Dakota, for recreation
_____ purposes; and

(2) WHEREAS, On the 1st day of February A. D. 19 60
Permit No. 563-2, with a date of priority of December 1, 1959

was issued to said applicant _____ for the diversion of said water, and provided for the completion of construction of the water
supply system therein described on or before the 26th day of January A. D. 19 65 and for the
application to beneficial use of said water on or before the 26th day of January A. D. 19 66

and whereas on the 18th day of May, 1970, the Permit was transferred
to the United States of America for administration by the Forest Service.

and:

(3) WHEREAS, It is hereby certified that the applicant has complied with the provisions of the laws of the State of South Dakota
relating to completion of the construction of the water supply system and is entitled to ~~next~~ store 32.7 acre feet
annually ~~xxxxxxx~~ of water for beneficial use and.

(4) WHEREAS, It is hereby certified that the applicant has complied with the provisions of the laws of the State of South Dakota
relating to the application of water to beneficial use of the following extent.

Water is used for public recreation purposes

(5) NOW, THEREFORE, By the virtue of the authority vested in us by the laws of the State of South Dakota, We hereby grant and confirm to the U.S. Forest Service

_____ of Custer

the holder _____ and owner _____ of said permit No. 563-2 a water right, dating from December 1, 1959

_____ to use of 32.7 acre feet annually ~~xxxxxx(x) xxxxxxxx~~ of the waters

of Iron Creek

in the County of Custer and State of South Dakota, or so much thereof as may be necessary for the

purposes hereinbelow mentioned, to be diverted at a point 1177 feet South 43° 05' East from the NW

corner, Section 27, T2S, R6E

and ~~conduct to and from~~ stored in place

for the purpose of public recreation

Subject to any limitations listed in Water Right Permit No. 563-2 and subject to the laws of the State of South Dakota.

WITNESS, My hand and seal of our office at Pierre, South Dakota

this 8th day of July A. D.

Nineteen Hundred and Seventy

WATER RESOURCES COMMISSION

By:

Chief Engineer, Executive Officer, J.W. GRIMES

Form 15.

Permit No. 563-2

Water Diversion No. 2 BATTLE CREEK Water District

CERTIFICATE OF CONSTRUCTION

This is to Certify, That U.S. Forest Service

_____ the holder _____ of
Permit No. 563-2, issued upon Application No. 563-2, bearing date of priority of December 1,
1959 authorizing the diversion of 32.7 acre feet annually ~~of the waters of~~
Iron Creek County of Custer, State of South Dakota at
a point 1177 feet South 43° 05' East from the NW Corner, Section 27, T25, R6E.

_____, for ± recreation

purposes, has a complied with the provisions of the laws of the State of South Dakota relating to proof of
completion of the works of diversion set out and described in said Permit; that said works are found in satisfactory
condition for diverting and conveying to the place of intended use 32.7 acre feet annually ~~of the waters of~~ of water.

Date July 8, 1970

WATER RESOURCES COMMISSION

By:

J.W. GRIMES, Executive Officer

(First Publication on or before January 1, 1960)

APPROPRIATION OF WATER

Office of State Water Resources Commission,

Pierre, S. Dak., December 7, 1959.

Notice is hereby given that ~~the Dakota West Corporation~~ whose postoffice address is ~~Huron~~ S. Dak., has made an application in accordance with the provisions of the water laws of South Dakota for a permit to appropriate for beneficial use ~~0.568~~ cubic feet of water per second of time from ~~the Iron Creek~~ through the ~~Mt. Rushmore Resort Diversion Works~~ the point of diversion of which is to be located on the ~~both~~ bank of said stream in the ~~NW~~ $\frac{1}{4}$ of the ~~NW~~ $\frac{1}{4}$ of Section ~~27~~ Twp. ~~28~~ Range ~~64~~. Said water to be used for the purpose ~~of providing irrigation on the following described land:~~
~~of resort operation plus irrigation of golf greens and other landscape areas~~

and for

This application will be taken up by the State Water Resources Commission at their office at Pierre for consideration upon the ~~26th~~ day of ~~January~~, 19~~60~~, at ~~2 P.~~ M. All interested persons may appear and be heard.

Appropriate action will be taken by the Water Resources Commission after suitable time has elapsed for the consideration of any or all information presented.

By: Carl H. Sundstrom—Publisher
 uster County Chronicle
 uster, South Dakota

State Water Resources Commission

By:

Chief Engineer, Executive Officer
 Eurtan F. Jones,
 Water Rights Specialist

PROOF OF PUBLICATION

STATE OF SOUTH DAKOTA }
 County of Custer } ss.

Carl H. Sundstrom being duly sworn, deposes and says the annexed printed copy of Notice of Intention to Appropriate Water was taken from the _____

CUSTER COUNTY CHRONICLE a newspaper which during the whole time of publication of said notice herein after stated, has been and is printed and published in the _____ City _____ of _____ Custer, _____ County of _____

Custer, and State of South Dakota; that the said notice was published in said newspaper on the following dates:

December 17, 1959

December 24, 1959

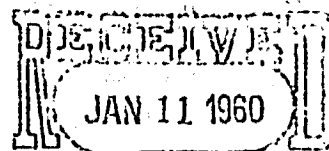
December 31, 1959

January 7, 1960

in each and every issue of the full number thereof, the first publication being made on the 17 day of December 1959 and the last publication on the 7 day of _____

January 1960, upon which days or times of publication aforesaid the newspaper was regularly published, and that during the whole time of said publication he was _____ the printer and publisher of the said newspaper.

(First Publication Dec. 17, 1959)
APPROPRIATION OF WATER
 Office of State Water Resources Commission
 Pierre, S. Dak., December 7, 1959
 Notice is hereby given that the Dakota West Corporation whose postoffice address is Huron, S. Dak., has made an application in accordance with the provisions of the water laws of South Dakota for a permit to appropriate for beneficial use 0.608 cubic feet of water per second of time from Iron Creek through the Mt. Rushmore Resort Diversion Works, the point of diversion of which is to be located on both banks of said stream in the NW 1/4 of the NW 1/4 of Section 27, Twp. 2S Range 02E. Said water to be used for the purpose of resort operation plus irrigation of golf greens and other landscape areas.
 This application will be taken up by the State Water Resources Commission at their office at Pierre for consideration upon the 26th day of January, 1960, at 2 P.M. All interested persons may appear and be heard.
 Approved and attested by the State Water Resources Commission after suitable time has elapsed for the consideration of any or all information presented.
 State Water Resources Commission
 By: Burton F. Jones,
 Water Rights Specialist
 50137



STATE WATER RESOURCES COM. 1.
 RECD. SOUTH DAKOTA

Subscribed and sworn to before me this 7 day of January A. D. 1960

Carl H. Sundstrom

Notary Public Custer County, S. D.

PROJECT: Dam and Reservoir for the Dakota West Corporation
Owner's Address: 4933 Third Street, S.E.
Huron, South Dakota

SUBJECT: Engineer's Report on Preliminary Survey, Design
and Cost Estimate

A. Location

The proposed dam would be located on Iron Creek in Custer County, South Dakota, approximately three airline miles southeast of Keystone. The centerline of the dam would cross Iron Creek at a point 1177' S. 43°05'E. from the northwest corner of Section 27, Township 2 South, Range 6 East, BHM. The reservoir at full stage would be ^{entirely} contained in the NW $\frac{1}{4}$ of Section 27.

B. Purpose and Requirements

1. Water supply for a proposed recreational resort. The water to be used for human consumption and general use, including fire protection, plus sprinkler irrigation of golf greens and tees and landscaped grounds. Sprinkling of golf course fairways is not contemplated.
2. The exact location of structures and the golf course layout are not determined at present, but it is anticipated that the principal area of use will be located in the SW $\frac{1}{4}$ Section 27. A schematic piping layout, showing location and anticipated amounts of water duty will accompany detailed construction drawings of the dam and accessories.
3. The estimated areas of greens, tees and lawns to be sprinkled is 22 acres. The requirement in irrigation water was computed at the rate of one inch of water per week per acre for a period of 18 weeks, from mid-May to mid-September, and estimated to be 33 acre feet, as maximum requirement for a dry season.
4. The design population at peak season is 750 people for a period of 18 weeks, from mid-May to mid-September, who will require an estimated 44 acre feet of water. The total requirement for the peak season, therefore, is estimated at 77 acre feet.

5. It is anticipated that the resort will operate for a nine-month season each year. During the "off-peak" operating season of 114 days, the design population is assumed to average 600 people who, during that period, will require an estimated 40 acre feet of water.

6. In summary, it is estimated that the annual water requirement will total approximately 117 acre feet, of which 77 acre feet will be required during the period, mid-May to mid-September.

C. Watershed Data

1. Area: 12.73 square miles, or 8,150 acres. This was determined by planimeter from U.S.G.S. quadrangles, 7½-minute series, showing forest coverage and contours at 40-foot intervals at a scale of 2,000 feet per inch.

2. Shape: The main channel length is 56,000 feet, as determined by wheeled map measure. The average width of watershed is 6,340 feet and the aspect ratio, L/W is 8.63. The difference in elevation between the reservoir site and the upper end of the main channel is 1,540 feet, or a slope of 27.5 per 1,000 feet.

3. Cover: The watershed lies in the Black Hills National Forest and has an estimated 85%-90% cover of coniferous forest which would, therefore, be classed as "dense". It also falls in the "pole" classification, wherein the dominant tree growth ranges from 4" to 12" diameter at breast height. The few open meadows have a good sod and grass cover.

D. Hydrology

1. Records of runoff from this watershed were not available and rainfall records near the site were not available in any significant measure. As a design criterion, the heaviest recorded 24-hour rain in Rapid City's 70-year weather records (5.57") was taken as a 70-year maximum for the watershed. The greatest intensity over a fairly large area, comparable in size to the watershed, was 2.58" in one hour. During small localized cloudbursts, covering one or two square miles in area, intensities up to 4.35" per hour have been recorded locally, but it is believed that this rate cannot justifiably be applied to the entire watershed. A maximum intensity of 3" per hour was adopted for the watershed area.

2. The highest deposits of old, water-deposited debris were noted at several points upstream from the reservoir site. From approximate channel cross sections, slopes and roughness characteristics, it is estimated that the debris was deposited by a flow of some 300 to 400 cfs.

3. The predominant surface soil of the watershed would probably be classed as a sandy loam. In a reasonably dry state this would have an absorption capacity of from 1.44 to 2.16 inches of water before runoff (U.S.D.C. record data). The average for the watershed was assumed to be 1.5". It was further assumed that, due to a 66% saturation at the beginning of the heaviest rainfall during a heavy thunderstorm, the residual capacity for absorption was reduced to 0.5" of water, or 1/6 of the heaviest rainfall, before appreciable runoff would begin.

Since the total of a 3" rain in the watershed is 2,038 acre feet, this would mean that some 340 acre feet would not reach the reservoir until long after the peak flow had passed. Concentration time from the centroid of the watershed is computed at 85-90 minutes.

4. The maximum rate of runoff was computed by the Burkli-Ziegler formula:

$$Q = MRc \sqrt{\frac{S}{H}} \quad \text{in which,}$$

Q = Cu.Ft./Sec.

M = Drainage area in acres, 8,150

S = Average slope, 27.5 ft. per 1,000 feet

c = Runoff coefficient

The value of "c" was given considerable study. For golf courses, pasture lands, etc., with good sod cover, the usual value is about 0.16 to 0.25. The measured runoff during closely supervised studies at the Bent Creek, N. C., Experimental Forest indicated values of "c", for forested areas, ranged from 0.0935 to 0.1134. A "c" value of 0.16 was used in computing the maximum runoff rate from this watershed to be 945 CFS, or 74.23 CFS per square mile.

5. The flow of water in Iron Creek was measured on October 20, 1959, using a 90° notch triangular weir of heavy sheet metal and reduced by King's formula: $Q = 2.52 H^{2.47}$. For a month preceding that date there had been no precipitation except a few minor rain or snow squalls which caused no runoff. The preceding summer has been unusually dry; hence, it is believed that these flows represent about the minimum rate to be expected. The flows were as follows:

Station 1: At the reservoir site in NW $\frac{1}{4}$ Section 27, Township 2 South, Range 6 East, BHM. Flow, 0.328 CFS, or 147 GPM.

Station 2: In SW $\frac{1}{4}$ Section 14, same township. Flow, 0.356 CFS, or 160 GPM.

Station 3: In SE $\frac{1}{4}$ Section 13, same township. Flow, 1.18 CFS, or 530 GPM.

It is evident that, in the deep canyon between Stations 2 and 3, there is considerable pick-up from underground aquifers which surface in the canyon.

E. Reservoir

The water line, with reservoir full, will be at Elevation 4460, with a capacity of 115.2 acre feet. The water line at the top of the portal to the spillway tunnel will stand at El. 4468 and the top of the dam at El. 4470. Between El. 4460 and El. 4468 the capacity of the reservoir basin will be 103.7 acre feet. Between El. 4468 and the top of dam at El. 4470 the basin capacity will be 34.5 acre feet. The capacity of the spillway will be 1159 CFS, without surcharge. A graph of the proposed reservoir and spillway capacities is appended. The losses due to evaporation and deep percolation are estimated to amount to 30" off the surface of the reservoir during the season from mid-May to mid-September. Surface area at El. 4460 will be 10.9 acres.

F. Dam

1. The dam will consist of a compacted earth fill, having the selected materials placed in the upstream part of the fill, with a rolled clay core section ranging in thickness from 16 feet in the core trench to eight feet at water line elevation. The upstream slope shall be 3:1 from El. 4470 to El. 4460, and 4:1 from El. 4460 to the upstream toe. The crest width shall be 12 feet. The downstream slope shall be 3:1 from El. 4470 to El. 4440 at which elevation a 20-foot berm is to be provided. From this berm the slope shall be 3:1 to the downstream toe. Top and downstream slope to be seeded with crested wheat grass.

2. The bed of the dam shall be stripped of all vegetation, sod or other deleterious materials and thoroughly scarified to improve bond with the embankment. The 16-foot core trench shall be excavated to bed rock or other impervious material and filled with clay compacted in 8" lifts with sheep-foot rollers of adequate weight to 95% of optimum density as determined by the modified Proctor method, water being added when required to govern optimum moisture. Compaction against rock abutment or other places inaccessible by roller to be by "terra-packer" or equal mechanical means.

3. The embankment shall be carried up in 8" lifts and compacted to 90% of optimum density, the denser material being placed in the upstream side; moisture content and compaction to be closely supervised.

4. The upstream slope shall be riprapped with rock placed on a 2" blanket of gravel, the combined thickness of rock and gravel to be not less than 9". The gradation shall be such that spaces between the larger stones are well filled with smaller fragments. The embankment shall be constructed to a superlevation of 3% of its depth to allow for possible

future settlement, with consequent reduction in freeboard.

G. Spillway

1. The spillway is to be a tunnel driven in the solid granite cliff forming the north abutment of the dam. The inlet portal, 16' wide x 8' high, with faired approaches, shall be shaped to broad-crested spillway nappe section for the short initial drop. The tunnel cross section to be decreased as increasing water velocity allows, but the capacity at no point to be less than that of the inlet portal. Any cracks or fissures noted in tunnel (or core trench) excavation to be grout sealed or gunited.

2. The spillway tunnel will not be lined, except that any sections showing multiple cracks may be gunited through such faulty areas. The greater length of the tunnel will be a 6.5' x 6.5' bore at a slope of -0.15. The spillway will discharge on bedrock below the downstream toe of the dam at an angle nearly coincident with the axis of the stream channel, the tailrace being deflected to the stream channel by a vertical rock cliff approximately 100 feet from the exit portal. The stream bed falls rapidly in a series of riffles below this point, so there should be no tailwater problem at the downstream toe of the fill. It is planned to stabilize that portion of the toe contained in the present channel with waste rock excavated from the tunnel.

3. The entrance portal will be protected by a floating boom or coarse grill at such distance from the portal that free flow into it will be maintained, to prevent the entry of floating trees, brush or logs which might lodge in the tunnel bore during unusual flood periods.

H. Other Accessories

1. The dam will have an 8" reservoir control line and a 6" water intake line. The control line shall have an inlet box equipped with a trash rack in the bottom of the reservoir near the upstream toe of the dam. The water intake line, leading from the infiltration gallery in the bed of the reservoir, will run parallel to the control line as it passes under the dam. Each line shall be of cast iron pipe, Class 150, with bolted mechanical joints and compression gaskets. They shall be constructed entirely in excavation and be fitted with at least two tapered concrete cutoff collars between the upstream toe and dam centerline and one in the clay core. Both these lines shall be installed and tightly backfilled before embankment is placed. The reservoir control line outlet will be on bedrock below the downstream toe of the dam.

2. A control house of concrete will be located below frost in the downstream berm of the dam and constructed before

embankment is placed. It will house the two pipe lines, valves, pumps and other controls for operation of the water supply and release of water from the reservoir.

3. A triangular steel plate weir is to be mounted in concrete immediately upstream from the reservoir to measure the incoming water. A water meter calibrated in cubic feet is to be installed in the control house to measure the rate at which water is being released.

1. Costs

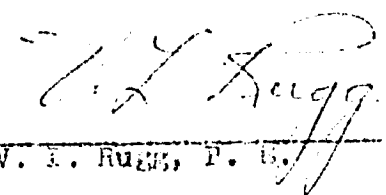
The cost of the dam and accessories, including spillway, control and supply lines, infiltration bed, control house and valves, but not including pumps, is estimated to be \$56,020. This gives an estimated cost of \$426.26 per acre foot of storage.

It is anticipated that the installation will have continuous supervision and operation by a resident caretaker, so that it may be operated in conformity with the policy established by the State Water Resources Commission.

Respectfully submitted,

STAVEN ENGINEERING COMPANY

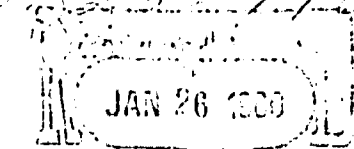
By


V. I. Rugg, P. E.

October 31, 1959

Harrison, S. Dak.
Jan 25 1910

Water Resources Comm.
Pierre, S. Dak.



STATE WATER RESOURCES COM. S. DAK.
PIERRE, SOUTH DAKOTA

Gentlemen,

You will find enclosed a petition protesting the granting of a Water right on Iron Creek to Dakota West Corp. of Huron Co. Dak.

We who circulated this petition are writing this letter in explanation.

Iron Creek is a tributary of Battle Creek and water taken from it directly affects the flow of Battle Creek. The names on the petition ^{are} every land owner and other interested parties on the Iron Creek, Battle Creek watershed that we know of.

There is a strong feeling that there should be no more water appropriated from this watershed as the people on lower Battle Creek are not getting the water that we have prior rights to, at the present time. In fact, as far above the mouth of Battle Creek as six miles, ranchmen are still, at this time hauling water for their livestock.

Yours, Respectfully,

Charles H. North
Edward Spicer

WE, THE UNDERSIGNED, BEING DIRECTLY AND INDIRECTLY AFFECTED BY THE FLOW OF WATER IN BATTLE CREEK BELOW THE POINT WHERE IRON CREEK EMITTES INTO BATTLE CREEK IN CUSTER COUNTY, SOUTH DAKOTA, PROTEST GRANTING OF THE APPLICATION OF DAKOTA WEST CORPORATION FOR A PERMIT TO APPROPRIATE WATER FROM IRON CREEK THROUGH THE MT. RUSHMORE RESORT DIVERSION WORKS.

<u>Name</u>	<u>P. O. Address</u>	<u>Date</u>
<u>Walter Henderson</u>	<u>Hermosa</u>	<u>Jan 21 1960</u>
<u>Virgil W. Williams</u>	<u>Keystone</u>	<u>Jan 22, 1960</u>
<u>John Mackel-</u>	<u>Keystone</u>	<u>Jan 22 1960</u>
<u>Leo Simpson</u>	<u>Hermosa</u>	<u>S Dak</u>
<u>Jack Paulson</u>	<u>Hermosa</u>	<u>Jan 22, 1960</u>
<u>Donald Hughes</u>	<u>Hermosa</u>	<u>Jan 22 1960</u>
<u>Shel Hughes</u>	<u>Hermosa</u>	<u>Jan 22 1960</u>
<u>Curt Wieringa</u>	<u>Hermosa SD</u>	<u>Jan 22, 1960</u>
<u>Clarence Kruth</u>	<u>Hermosa W</u>	<u>Jan 24, 1960</u>
<u>Donald Barone</u>	<u>Hermosa S.D.</u>	<u>Jan 24, 1960</u>
<u>Lewis Mills</u>	<u>Hermosa D.R.</u>	<u>Jan 23-1960</u>
<u>Jack Zasadie</u>	<u>Chairman</u>	<u>Jan 23-1960</u>

WE, THE UNDERSIGNED, BEING DIRECTLY AND INDIRECTLY AFFECTED BY THE
 FLOW OF WATER IN BATTLE CREEK BELOW THE POINT WHERE IRON CREEK ETTIES INTO
 BATTLE CREEK IN CUSTER COUNTY, SOUTH DAKOTA. PROTEST GRANTING OF THE APPLICA-
 TION OF DAKOTA WEST CORPORATION FOR A PERMIT TO APPROPRIATE WATER FROM IRON
 CREEK THROUGH THE MT. RUSHMORE RESORT DIVERSION WORKS.

<u>Name</u>	<u>P. O. Address</u>	<u>Date</u>
<u>Charles L. Phelps</u>	<u>Hermosa, SD.</u>	<u>Jan 19, 1960</u>
<u>Leonard Kainer</u>	<u>Hermosa, SD.</u>	<u>1-19-60</u>
<u>Donald Kainer</u>	<u>Hermosa, SD.</u>	<u>Jan 19, 1960</u>
<u>W. W. Phelps</u>	<u>Hermosa, SD.</u>	<u>Jan 19, 1960</u>
<u>Lee Wiley</u>	<u>Hermosa, SD.</u>	<u>Jan 19, 1960</u>
<u>Norman Walton</u>	<u>Hermosa, SD.</u>	<u>Jan 19, 1960</u>
<u>Francis Cusker</u>	<u>Hermosa, SD.</u>	<u>Jan 19, 1960</u>
<u>W. C. Brophy</u>	<u>Hermosa, SD.</u>	<u>Jan 19, 1960</u>
<u>Louis Brophy</u>	<u>Hermosa, SD.</u>	<u>Jan 20, 1960</u>
<u>Jack DeBahr</u>	<u>Hermosa</u>	<u>Jan 21, 1960</u>
<u>S. J. Lutz</u>	<u>Hermosa, SD.</u>	<u>Jan 21, 60</u>
<u>David H. Allen</u>	<u>Hermosa, SD.</u>	<u>Jan 21, 60</u>
<u>Ed. J. Luster</u>	<u>Hermosa, SD.</u>	<u>Jan 21, 60</u>
<u>P. W. Ferguson</u>	<u>Hermosa, SD.</u>	<u>Jan 31, 60</u>
<u>John J. Luster</u>	<u>Hermosa, SD.</u>	<u>Jan 21, 60</u>
<u>Jack J. Luster</u>	<u>Hermosa, SD.</u>	<u>Jan 22, 60</u>
<u>Norman Battle Creek Ranch</u>		

REPORT OF A MEETING
HELD IN STOCKGROWERS COMMUNITY ROOM
RAPID CITY, SOUTH DAKOTA
SEPTEMBER 28, 1961

A committee representing stockgrowers on Battle Creek together with representatives of Dakota West, Incorporated met with J. W. Grimes, Executive Officer of the State Water Resources Commission and Raymond F. Lund, also from the Commission. Those present included the following:

Charles Phelps, Hermosa
Francis Brophy, Hermosa
Walter O'Neill, Hermosa
John T. Colgan, Hermosa
Charles Brophy, Hermosa
Terril Brophy, Hermosa
Ed Anderson, Rapid City
J. R. Anderson, Platte
Ed Wergin, Rapid City
V. L. Rugg, Rapid City
J. W. Grimes, Water Resources Commission, Pierre
Raymond F. Lund, Water Resources Commission, Pierre

John T. Colgan of Hermosa served as chairman of this informal meeting, which was held for the purpose of arriving at a better understanding of the relationships between Dakota West, Incorporated and the ranchers living on Battle Creek, with respect to a water permit which had been previously granted to Dakota West, Incorporated for a limited amount of water to be stored for their use.

In opening the discussion, Mr. Colgan referred to a meeting that had been previously held in Ed Wergin's offices in Rapid City, and to a later meeting held in Rapid City on Monday, September 8th, at which time a group of interested parties directed questions to Raymond Lund, who had been asked for such a meeting.

With this brief background, Mr. Grimes was then asked to explain the water permit which had been granted to Dakota West, Incorporated, a corporation which has planned a development project on Iron Creek.

In referring to a file copy of the permit which had been granted, Mr. Grimes read the restrictions which placed certain limitations on Dakota West, Incorporated water right. For example, only the unappropriated water could be stored. Although some of this unappropriated water could be stored in a reservoir, under the physical and climatic situation which prevailed in the area, it would be only the snow melt water available for storage such as contemplated by Dakota West, Incorporated. There are other times when water might be stored, but only at the time of high flows - high flows might be defined as the time that the flow from Battle Creek reaches the Cheyenne River.

Again, emphasis was placed on the fact that only the unappropriated water could be diverted or stored for use. At any stage of the reservoir, passage of water is provided. It was noted that Dakota West, Incorporated proposes to install a 12" diameter tube in the reservoir to allow for passage of water.

Reference was made to evaporation losses that occur. In view of the small reservoir involved here, apparently evaporation would not amount to much. The evaporation might be considered as an offset to loss that would otherwise occur in the creeks. Excess waters downstream would represent unappropriated water.

It was further pointed out that certain conditions had been imposed on the use of water from the dam. Water at the point of use may raise a question with respect to the quality as well as quantity. Further, concerning flows into the Cheyenne River, it was stated that it would not be necessary to have a stream flowing constantly in order to determine what might represent high flow or unappropriated water. For example, water left in pools at various points along the stream may suffice to provide that needed for domestic use. Then, of course, the matter of determining quality and the quantity of the water in the pools left in the stream would be subject to evaluation by interested parties.

It was explained that water might be stored to the extent of its loss into the limestone area. With respect to evaporation loss, that would be subject to the temperatures, the season, etc. In further reference to excess water, in the event of a heavy rain or storm the same condition exists as at the time of a heavy snow melt. There would be more water flowing downstream than could be put to use by those interested in using the same. In that case, it represents excess or unappropriated water.

Carrying the thought a step further, there might be ranchers on the Cheyenne River, for example, who could point to Battle Creek as a tributary and thus, an important segment of the Cheyenne River, since the Cheyenne River represents the contribution of various tributaries of that stream.

Measuring devices may be installed to record the in-flow to the proposed storage reservoir but even that would not tell the whole story.

Mr. Brophy asked, suppose several storage dams are built on the tributaries of Battle Creek, what effect would it have on the flow? Of course, the answer to that question would depend on the number of storage dams built, as well as a number of other factors.

Many times the flow downstream will show up heavier than the flow upstream. The point was made that if the reservoir is so located that water would be diverted directly into it at times of high flow with the natural flow to be passed that, in itself, would obviate the question which has arisen concerning the stoppage of water in the stream bed of the creek.

Mr. Colgan stated that it appeared we are in agreement as to when to store the water. The next question is how to pass the flash floods through the dam. Obviously a 12" pipe would not pass a flash flood in the surges that would be required to carry water over the limestone area. Mr. Rugg pointed out that under a nine foot head a 12" pipe would deliver about 8½ cfs while under a 25 foot head the rate of delivery would be 14 cfs.

It was pointed out it might require some time to fill the reservoir from the level of the pipe to the emergency spillway.

Mr. Grimes stated if we assume that a flash flood did not exceed the capacity of the dam, the gate must be left open for a short time. With the gate left open, even then as the reservoir fills, a high head of delivery would be maintained as nearly as possible through the operation of the reservoir. As to the volume of water going through the pipe, to increase the velocity through the pipe, the friction loss increases as the square of the diameter of the pipe decreases.

If the pipe could be increased to 2'4" it would increase the flow about three times.

It is recognized that the flows which get into the Cheyenne River are really wasted water insofar as the users on Battle Creek are concerned. A question was directed to Mr. Rugg about the possible enlargement of the pipe.

One concern of the ranchers involved the time when the gate would be open. For instance, supposing a four inch rain were to occur at 2 A.M., the peak of the flood below the dam would have passed before anyone would be up to open the gate to release water which otherwise should have been released to add to the surge in sufficient volume to pass the sink holes in the limestone area as desired by the ranchers.

In response to a question concerning the size of the spillway over-flow, Mr. Rugg stated the plans call for an eight foot freeboard - the spillway is twelve feet wide so that they could handle about 1,200 cfs. Further, to prevent the pipe from plugging up, provision has been made for a boom to prevent trees and logs from jamming the pipe as well as the spillway. If the pipe were to be installed with a valve, then a question would arise concerning the operation of that valve. What would be expected in the way of regulation of that valve? Would it be left half open, a quarter open, or three fourths open, or open completely? This question was raised in consideration of the operators downstream.

The operators are concerned about rates of flow which would permit passage of water over the limestone. The handling of the valve could present a problem as it might be somewhat difficult

to regulate. Mr. Grimes asked Mr. Rugg if he could estimate the cost of doubling the size of the pipe. Mr. Rugg, stated, in his opinion, it would cost about five times that of a 12" pipe. He seemed to be of the opinion that it would cost around \$3,000. to install a 12" pipe while a 24" pipe might run anywhere between \$12,000. and \$15,000. This is merely an estimated guess subject to careful scrutiny and question.

Mr. Wergin stated that as Manager of Dakota West, Incorporated he desired a definite conclusion so they would know where they're at with respect to planning the commercial business development which is contemplated.

Mr. Grimes explained that in the event of any serious question, an appeal could be made to the Water Resources Commission, and beyond that an appeal could be made to the courts. Mr. Wergin asked, if there is no particular snow melt, when do we store water? Once water is stored in the reservoir the commercial enterprise would have the use of that water throughout the year.

Mr. Rugg pointed out there are only eight acres contemplated for a golf course and then it is only the greens that they are interested in watering. It would require about eight inches of water per week. The fairways will not be watered. Taking the optimum use, one inch per acre per week, or eight inches as in this case, per week, would be used. This figure is based on that used for cemeteries, golf courses, etc.

The question was raised - what about putting down a well, perhaps somewhere near Hermosa - in lieu of putting in a large pipe with valves, in the dam? In furtherance of that question

Mr. Rugg asked - suppose that they were to supply a one hundred thousand gallons of water by diversion from such a well, would they, the corporation, be allowed that amount of water diversion elsewhere? Mr. Grimes stated that the arrangement would be the same as in the relationship that now exists between Rapid Valley and Rapid City. However, if a well were to be put down, then the question would arise - would the water users between the dam and the well be satisfied?

It was stated that the creek had been dry between Hermosa and the sink area during the past six weeks.

Mr. Vergin called attention to the importance of having the issue clarified now because they want to avoid potential trouble at a later date.

With respect to any concern about establishing a precedent in granting the permit on Iron Creek, Mr. Grimes pointed out that any consideration to be given by the Commission goes through the same procedure as at the time the application is made for water on any given stream or from any particular source. He assured the group it is not the intent of the Commission to over-appropriate the waters of the stream.

The question was raised as to whether or not there were any political issues involved in the granting of water rights? To this the answer was 'no' - not as far as anybody could determine. The applicant still has the right of appeal to the courts. As a matter of fact, serving as an administrative agency, the Commission acts as a buffer between apparent conflicting interests and the courts.

If a federal case were involved, then the only solution would be through the courts. The United States does not maintain any water administrative agency such as we maintain in South Dakota and such as is maintained in the individual western states.

A navigable stream, as we know, is subject to Congressional jurisdiction, but is assigned to the Corps of Engineers for the handling of that jurisdiction.

Mr. Colgan, in summarizing, stated it appears that Dakota West, Incorporated can divert or store only the snow melt or excess waters when flowing in the streams, to the Cheyenne River. In any event, water is not to be stored at any time until after it is flowing at the mouth of Iron Creek. It was pointed out that domestic use has priority, hence the water users have a preference which is ahead of any storage rights that may be granted. It might be pointed out that when the snow melts in the hills, it is similar to the situation which prevails on the plains, that thawing or melting will develop about the same time, and perhaps take place a little faster on the plains than in the hills.

Mr. Colgan mentioned the fact that they felt they had been snubbed by the Forest Service officials when a meeting had been previously called for interested parties on Spring Creek and State Forest Service officials did not show up. Mr. Grimes indicated that by calling an official meeting, making it part of official state business, the Forest Service officials would have less occasion to ignore such a meeting when the group is called together to discuss problems of mutual interest. Mr. Colgan went on to point out that recently, Forest Service officials had been more considerate and it now appeared that

they would co-operate as necessary.

Mr. Grimes stated that in case of disagreement concerning the use of water, an agreement among the users themselves is the best arrangement that can be entered into. Likewise, agreements reached through the Commission would be better perhaps than the court decisions.

A question - what is the irrigation season? It is considered the season during which water can be applied beneficially. It is usually considered to be the growing season but this is not technically correct. For purposes of irrigation contracts, May 1st to October 1st has been defined as the irrigation season.

In further reference to the storage of water, Dakota West, Incorporated proposes an installation that is conceived and designed so as not to interfere with any existing water right on Iron and Battle Creeks. Mr. Rugg asked - will a water right obtained on a stream representing less than eight percent of a particular watershed actually hurt water users in the lower reaches of the stream? The answer - it may or may not hurt depending upon the facilities constructed and the time storage or use.

Mr. Grimes pointed out it is well for a group like this to get together in order that information may be exchanged and that which is obtained from both sides may be considered. It is the purpose of Dakota West, Incorporated to divert water at a time when others are not hurt.

Mr. Vergin again raised the question as to when water might be stored? Mr. Grimes stated that there is no question in the

minds of the Water Resources Commission that unappropriated waters exist. This water is spring runoff and other periods when flows are in excess of downstream needs. This water may be stored for later use. To what degree will facilities meet natural low flow conditions? This appeared to be a major question - how big should the outlet be?

Attention was directed to the fact that the water which gets into the Cheyenne River from Battle Creek is perhaps a measure unappropriated water which could be assigned to the corporation.

With respect to procedures involved, if someone or group consider themselves harmed, they may go directly to the Commission, or to the courts, or to the courts after the Commission had made its decision.

The installation of a recording gauge to record the reservoir level seemed to be one way of making the determination as to when the corporation would be entitled to store water. An automatic recorder would show the reservoir level. It would be necessary to change the paper once every eight days. It would have the advantage of showing the history of the elevation at all times.

It would be possible to put a recording gauge downstream below the outlet works on the dam, so as to measure overflow including that from the emergency spillway, if necessary. At present, a gauging station is maintained at Battle Creek below Hermosa. A person could put an accumulative reading gauge on the tube which would measure the rate of flow and provide an

accumulative record of the amount of water passed through. This appears to be unnecessary with a recording gauge on the reservoir.

With respect to the evaporation loss from the reservoir, it was pointed out that would be absorbed by Dakota West, Incorporated. On a small pond such as contemplated, the loss would approximate about 25 acre feet per year.

Again, in further reference to making an appeal, water users would have final recourse of appeal to the courts.

Mr. Grimes asked if after two years it is observed that the 12" pipe is not doing the job, then what? It was suggested perhaps a larger pipe could then be installed. The question would arise as to proof that the 12" pipe was not doing the job. The important thing is to replace the flows that would normally be in the creek during periods when such water is required and would satisfy downstream for domestic use and prior water rights. Mr. Grimes said he would re-examine the question in the light of the information that had been presented and discussed. To assume that the only source of water in Battle Creek was in Iron Creek and was 50 cfs, the loss during four hours would be much less than with an 8 cfs discharge over a period of 25 hours. To increase the flow over a longer period of time would also increase the loss. If we were thinking in terms of ten drops of water out of fifty, out of Iron Creek contributing to the loss, it would be impossible to measure. The first 3 cfs water to hit the limestone area will provide the water loss regardless of the source. It is entirely conceivable that water from tributaries, other than Iron Creek, would be the first to hit

the loss area, therefore, providing all of the loss involved. Giving further consideration to this phase of run-off, we know that not all of it would reach the loss area at the same time. Water on the flatter upstream surface tributaries could be a couple of days later, depending upon the amount of rain, drop in elevation, and other factors involved. It is possible to get at the flow relationships to rain in reaches of the river. Sometime during the flood flow period, when the gates are open, it will prove beneficial. Flows in the streams spread out over enough time so that above the loss area it builds up rapidly to a peak but levels off toward Hermosa. If we were to superimpose operations of a reservoir, it would peak up a little lower and lengthen out the flow after the flood peak. For illustrative purposes, reference was made to a graph. Any flows greater than 3 cfs would get beyond the loss reaches of the stream.

It was also pointed out that perhaps it would be possible to install an electronic device which would actuate a conditioner to open the valve. This would be automatic, but it would be expensive, too.

It was suggested that it would be well to install a measuring device in the loss area, say just above the loss area.

Consideration was given to ways and means by which the dam would help, by storing up water and then releasing it in slugs to carry over the limestone area in time of a low flow. This would be very helpful.

It would involve a problem for the operator in handling the operation of a reservoir under those conditions. In any

event, the operation of a reservoir has to conform to that which is outlined in a permit. The question was asked if the ranchers were to bargain for the release of water at certain times, could an equivalent amount be stored or replaced at other times? The answer - "yes, it is possible". It would be a matter of trading among the water users. For example, if an emergency were to arise, an agreement between the water users and the corporation would be all right as long as it did not violate provisions of the law. The Commission must make the determination as to whether or not other water users are injured under such an arrangement. If such arrangement were made, a copy should be sent to the water Resources Commission so that it could be put into the water right records.

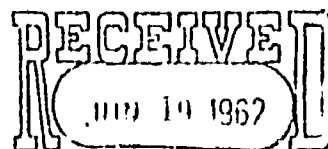
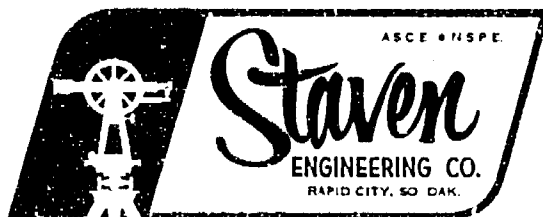
Mr. Grimes stated that in dry seasons the stream beds get so dry, it takes a lot of water to soak up the bed.

Reference was made to the Carl Brown report prepared in 1944 concerning Battle Creek. It was made for Senator Francis Case. In that report it was pointed out that the loss in the limestone area ranged from 80% to 90%, whereas in the sandstone area the loss would range from 10% to 15%. Mr. Grimes called attention to some work that had been done on French Creek, where a pipe had been installed to carry water through a sink hole area. Since that 12" pipe has been installed, capable of carrying about 5 cfs for 3,600 feet, there has been, apparently, better supply^s of water in wells in the area, whereas before the installation, wells going dry in the French Creek area seemed to be a common occurrence at certain times of the year.

In response to a question as to how a watershed plan would work, it was pointed out that here, there is interest in low flows which is just the opposite for purposes of a watershed. Furthermore, the Soil Conservation Service Watershed Program, under Public Law 566, is limited to an area not to exceed 250,000 acres. If it is larger than that for handling water, it naturally goes to the Corps of Engineers for one of their projects.

It might be concluded that this conference was useful even though no definite decisions were reached at the time. Mr. Grimes again assured the group that he would make a study of the situation.

RAYMOND F. LUND
District Specialist



STATE WATER RESOURCES COMM.
PIERRE, SOUTH DAKOTA

P. O. BOX 1072

AREA CODE 605

PHONE 343-0222

RAPID CITY, SOUTH DAKOTA

June 16, 1962

Mr. J. W. Grimes, Chief Engineer
S. D. State Water Resources Commission
Pierre, South Dakota

REFERENCE: Permit No.: 563-2
Report on Dam Relocation & Redesign for
Black Hills Biltmore Corporation

Dear Mr. Grimes:

Reference is made to a short discussion we had relative to redesign of the dam and spillway for the above project during the Weather Modification Research Conference here last February. The discussion was very brief, because available time was short, ending in a verbal concurrence with principle features of the redesign and a request for the submission of the revised plans, specifications and report. These are submitted herewith. *(Under separate cover)*

1. REASON FOR RELOCATION AND REDESIGN.

On February 14, 1962, the Custer office of the U. S. Forest Service informed Mr. Ed Wergin, president of Black Hills Biltmore Corporation, of hitherto unsuspected procedural and legal requirements pertaining to construction of the proposed dam on U. S. Forest land. These requirements included: (a) review and approval of complete plans, specifications, field investigations, findings and design studies by the Chief Engineer, U. S. Forest Service, at Washington, D. C.; (b) purchase or release of the most recent mining claim of record encumbering the land, and (c) search for heirs of original locator of mining claim (1946; now deceased) and quieting of title with respect to the rights, however slight, of the original locator. Estimates of time required to accomplish the above ranged from 2-1/2 to 3 years, with an unknown expense in legal fees.

It was decided to relocate the dam in such fashion that all construction would be contained on property presently owned by the corporation. This would require that the

spillway be so located and designed as to effect a return of the spillway discharge to stream channel entirely on said property. Return of such water to stream channel at a point outside the property would fall in the category of construction (tailrace excavation) on U. S. Forest lands encumbered by mineral claims and would entail conformity with the requirements listed above.

2. REDESIGN OF DAM.

To construct the conventional type of rolled earth dam, with slopes flat enough to keep permeability and precolation within safe limits, would result in a severe loss of storage capacity since the most effective part of the reservoir basin would be occupied by the embankment.

To minimize this loss, a dam of composite cross section was designed; the upstream portion being a riprapped, rolled earth fill with 3:1 slope and the downstream portion being a rock-and-gravel fill with 1:1 downstream slope; permeability and percolation to be controlled by a diaphragm of galvanized, interlocking, corrugated, sheet steel piling anchored in bedrock.

Location of the downstream toe of the dam at stream crossing was dictated by the location of the north property line, which also determined the location of that portion of the dam lying west of the stream. East of the stream the dam centerline was located to take optimum advantage of topography which resulted in a swing away from that property line. At the angle point in the centerline, Sta. 3+70 (see Sheets 3 and 4 of plans), a gradual transition is made from rock fill to earth fill at 3:1 slope in the downstream portion of the embankment. The steel diaphragm is continued to Sta. 3+25 at which point the maximum head, with full reservoir, would be about 15.5 feet. Here it is stepped down and continued only to seal the porous subsoil stratum to Sta. 1+00. At this point previous investigations indicated that the stratum material has become modified to schisty sand with a small clay content.

Freeboard of the dam was reduced to six feet because that is the limiting elevation of the topography at the east abutment. To increase this freeboard would require construction on U. S. Forest land or an infeasible, basin-filling dike to circumvent property corner No. 5.

Between Sta. 0+00 and Sta. 1+00 the top of the dam is finished off at Elev. 65.5 forming, in effect, a shallow secondary spillway. This was done not so much for the purpose of securing additional spillway capacity but to ensure that, in the very remotely possible case of a flood too great for the spillway to carry with 5.5-foot head, the overflow

would occur for a short period at a point where the water would have to traverse a brushy-rock-studded slope to rejoin the stream about 300 feet from the overflow section, with minimum chance of injury to the dam.

3. REDESIGN OF SPILLWAY.

The spillway, having a notch 6 feet deep and 20 feet wide, has a short approach forebay with radial wings to minimize turbulence and restriction of flow over the lip of the spillway. The overfall curve of the flume bed is designed from the coordinates of the lower nappe of a weir having a downstream slope of 1:1. The training walls and sides were designed to contain the upper nappe of the same as computed on the assumption of a 6-foot head on the spillway at the entrance to the forebay. Corrected for velocity of approach, the spillway would have a theoretical capacity of 1020 CFS at 5.5-foot head and 1278 CFS at 6-foot head.

The spillway received much study. Obviously, a conventional type spillway of reinforced concrete could not be constructed on the fill as it would soon be wrecked through settlement. If the structure was carried to bedrock to avoid this, the cost would be prohibitive. The drop inlet, or "morning glory" type, with anti-vortex features and a vertical stack resting on bedrock, was considered but discarded due to the high incidence of brush and driftwood debris from flash floods in this type of watershed.

The spillway, as designed, is of composite construction. The reaction bucket, apron and sidewalls are of reinforced concrete. All walls, including the curtain wall at the downstream end of the apron, are anchored into bedrock, which surfaces in the stream bed about 60 feet downstream from the apron. At the location where the hydraulic pump would normally form in the conventional, stilling-pool type of bucket, the walls are flared out at 45° and the floor of the apron given a negative grade of 5 percent to decrease the height of the jump, spread the discharge flow to a wider section and minimize possible winter ice trouble in the bucket. High velocity discharge poses no problem in this case because of stream-bed conditions noted above. The stream bed drops about 6 feet in the next 200 feet of channel.

The overfall and flume are of welded steel construction in the form of three articulated steel sections with three slip joints to permit adjustments to compensate for settlement and thermal expansion or contraction. Each section is fixed at its upper end and "floats" in the next section downstream. The top section is welded into the steel diaphragm of the dam; the intermediate and lower sections being secured

to concrete anchor walls in the rock fill.

These anchor walls, and the slip joints in the flume, are so designed that, should future settlement of the rock fill be greater than anticipated and cause undue stresses in the flume sections, they may be loosened, raised, re-aligned and secured with a minimum of expense. For this reason the flume is designed to rest on top of the downstream slope, rather than to be embedded in it.

The pump house was relocated on the left bank of the stream for better accessibility but all the essential elements of water diversion and reservoir control remain the same as in the previously approved plans. There has been no change in the purpose of the installation.

4. COMPARISON OF FEATURES: ORIGINAL AND AS REVISED.

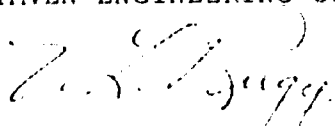
	MAXIMUM DEPTH OF FILL IN CHANNEL	MAXIMUM DEPTH WATER AT UPPER TOE	STORAGE CAPACITY ACRE- FEET-	SURFACE AREA ACRES
Original:	42'	27'	115.2	10.9
Revised:	29'	21'	96.1	9.3

Bids were invited on the revised dam and appurtenances at once, the construction to be contingent upon approval of the revised plans and specifications by your office, with incorporation of any required changes to be done by negotiated change orders. The bids received appeared to be excessive indicating, in my opinion, that the bidders had too much work backlogged to be interested in truly competitive bidding and/or were not too familiar with techniques of this type of construction on "live" water and were simply afraid of the job at this time of year.

Progress of the construction phase is halted, pending the build-up of stronger financial reserves. During this interim we wish to clear the approval of these revised plans and specifications by your office.

Very truly yours,

STAVEN ENGINEERING COMPANY


V. L. Rugg, P. E.

VLR:lmw

DECLARATION OF INTENTION

WHEREAS it is the intention of UED Company, a Joint Venture consisting of United Builders, Inc., Mack Construction Co., Inc., and Demco, Inc., hereinafter referred to as the "First Party", and the Black Hills Biltmore Corporation, a South Dakota Corporation, hereinafter referred to as the "Second Party", to declare their intention relative to mutual obligations involved in the construction of a terminal resort facility on property of the said Second Party, as concerns proposed finance, construction and leasing of resort facilities.

NOW, THEREFORE, THE PARTIES HERETO agree as follows:

A. First Party Agrees:

1. To enter into contract with the Second Party for the construction of all capital improvements and facilities.
2. To complete arrangements for the procurement of mortgage financing agreeable to the Second Party.
3. To complete arrangements for interim financing during the period of construction.
4. To complete arrangements for the procurement of all furnishings and equipment. Should the Second Party desire to secure leases for any or all furnishings, the arrangements for such leases shall be made by the First Party.
5. To furnish a performance and payment bond in the amount of 100% of the "sums required for the construction of all capital improvements and facilities".

B. Second Party Agrees:

1. To enter into contract with the First Party for the construction of all capital improvements and facilities.
2. To enter into a Mortgage Loan Contract with parties selected by the First Party.
3. To make available to the First Party all plans and specifications for the proposed capital improvements and facilities.

4. To make available to the First Party all necessary financial statements, report of stock sales and financial data required by the mortgage lender.

5. To make payments to the First Party all "sums required for the construction of all capital improvements and facilities".

6. To make payment to the First Party a Contractor's Fee equal to 6% of the "sums required for the construction of all capital improvements and facilities".

7. To make payment to the First Party a Finance Procurement Fee equal to 2 1/2% of the "sums required for the construction of all capital improvements and facilities".

8. To make payment to the First Party the total amount of costs incurred in the furnishing of a 100% performance and payment bond.

C. Both Parties Agree:

1. That the term "sums required for the construction of all capital improvements and facilities" shall be defined as to include the actual costs, as defined in Article 5 of A.I.A. Form 105, of all material, labor, subcontracts, direct job supervision, and the cost of interest of interim financing as accrued by the First Party.

2. That the Contractor's Fee and the Finance Procurement Fee shall not be computed on the costs of performance and payment bond, architect's design fees, engineer's design fee, engineer's or architect's inspection or construction supervision fees, or any other professional service fees contracted for by the Second Party.

3. That the Second Party reserves the right to cause the First Party to enter into contracts with such subcontractors or material suppliers as may be selected by the Second Party even though such contracts may increase or decrease the total costs.

4. That in event the First Party does not complete arrangements for mortgage financing acceptable to the Second Party within ~~30 days after receipt of all necessary statements as stated in B.3 and B.4 above, this Declaration of Intention shall become null and void.~~ 90 days after receipt of all necessary statements as stated in B.3 and B.4 above, this Declaration of Intention shall become null and void.

(P.100)
S.M.
C.H.

THIS AGREEMENT to be effective upon signing by all parties hereto.

Dated this 5th day of February, 1962.

ATTEST:

BY: [Signature]

Secretary

BLACK HILLS BILTMORE CORPORATION

BY: [Signature]

President

ATTEST:

BY: [Signature]

UNITED BUILDERS, INC.

BY: [Signature]

President

ATTEST:

BY: [Signature]

MACK CONSTRUCTION CO., INC.

BY: [Signature]

President

ATTEST:

BY: [Signature]

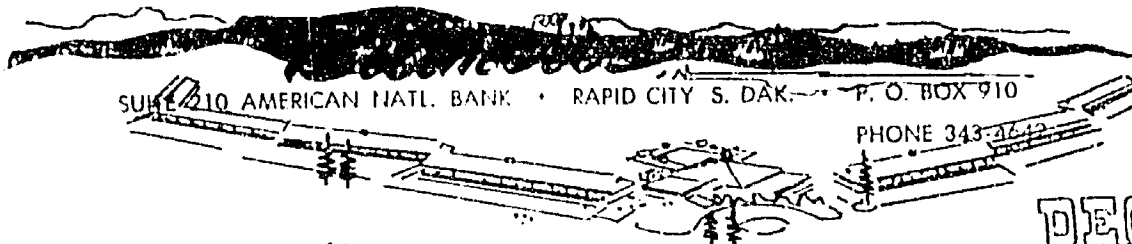
Secretary

DEMCO, INC.

BY: [Signature]

President

BLACK HILLS

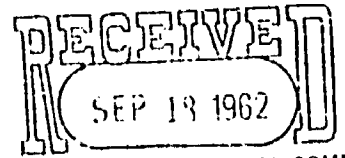


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PHONE 343-4642

September 17, 1962

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STATE WATER RESOURCES COMM.
PIERRE, SOUTH DAKOTA

Mr. J. W. Grimes, Chief Engineer
South Dakota State Water Resources Commission
Pierre, South Dakota

Dear Mr. Grimes:

Permit No. 563-2

The above Permit was originally issued to Dakota West Corporation and then as part of the land purchase agreement it became the property of Black Hills Biltmore Corporation.

We have visited about the many difficulties surrounding our project, particularly with respect to construction of the dam by reason of Forest Service problems.

I became involved in this project in 1961. Prior to my involvement Mr. Lusk and his attorney, Mr. Bakewell, attempted to consummate a land exchange with the Forest Service. The purpose of the exchange was to give the Corporation a very small strip of Forest Service land adjoining the land owned by the Corporation for purposes of building a very simple and direct dam across Iron Creek. There were innumerable delays because no one in the Service seemed willing to give a direct decision. There was always the indication that the exchange could be made within a short period of time. Instead of a direct decision there was a constant request for additional information.

We instructed Staven Engineering to design the dam and the entire water system. During the month of December, 1961 Vic Rugg of Staven Engineering and I made one of our frequent visits to the Custer Forest Service office. At that time we were definitely informed that the land exchange would take at least another two years. We were informed that the best way to proceed would be to file application for a 20 year Special Use Permit which would give the Forest Service adequate time to handle the exchange. We were told this could be done by the Custer office in a comparatively short period of time. We were given a long list of materials which they would need in order to approve the application.

During January, 1962, requests were made for additional information from us.

During a visit to their office on February 7, 1962 we were advised that the Custer office had decided this was really too large a project for them and would need to be reviewed by the Denver office engineering staff. We were also told that some certain additional information would be necessary for Denver.

The Custer office accepted our suggestion that we would return to Custer on February 14 with all the information they had requested, and prepared to personally deliver the plans to Denver after Custer had approved them. Mr. Rugg and I had made plans

Mr. J. W. Grimes
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for an airlines flight to Denver to follow through the approval at that point.

On February 13 I received a phone call from Custer advising me that we would need to get approval first from Mr. Rudy Benson, Hill City Ranger. They promised there would be no delay.

On February 14 Mr. Rugg and I visited Mr. Benson and after several hours of conversation obtained his approval for our plans. We arrived in Custer shortly after lunch in the belief that the Custer office would approve our plans and arrange an interview for us in Denver the following day. Upon our arrival in Custer we were dismayed to find both the Regional Supervisor and his deputy out of the office, even though we thought we had firm appointments. The third man in line of authority was available but only for the purpose of telling us that upon further checking they had decided the entire plans needed to be approved by the Chief Engineer in Washington, D. C., and that therefore the plans would need to be checked very carefully. We could gain no assurance that the Permit would ever be issued or that it could be accomplished in anything less than twelve months.

We did leave application for a Permit to cross Forest Service lands with our water lines and also sewer lines.

Staven Engineering was instructed to design the entire project to permit construction of the dam entirely on our own property. Bids were opened for the construction of the entire water and waste systems (including a redesigned dam) on April 12, 1962. Costs were exorbitant so additional designing work was done in an attempt to reduce the costs.

Bids were opened again on May 23, 1962 which reflected lesser costs but still excessively above the engineers' estimate. The Joint Venture, supplying the long-term loans, insisted they could not finance this part of the project at such a cost.

As you know, excessive rainfall occurred beginning May 14 and continuing through most of July. We were advised to do nothing until things returned to normal.

In the meantime we received permission to cross Forest Service property with water and sewer lines on April 11, 1962.

On July 11, 1962 our application for certain other Forest Service areas were approved with a stipulated annual fee of \$928.00. As a result of an inquiry requesting more definite information as to the procedure followed in arriving at the fee, the Permit was flatly rejected, but finally reapproved on August 8 after quite considerable Congressional intervention.

In the meantime a mining claim had been filed on Forest Service land at a point critical to our construction. This mining claim was directly over another claim filed in 1948, but the Forest Service refused to rule on the validity of either claim. Finally a third claim was filed on top of the two original claims. We contended that there would be a serious question as to the true and valid claim and were prepared to make settlement with valid claimants. The Forest Service refused to make a ruling.

Mr. J. W. Grimes
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On September 5, 1962 our attorney, after considerable research, determined that the Forest Service could issue Permit subject to any claims and that our use of the area would be at our risk and not at the risk of the Forest Service. The application for the Permit was reinstated on September 6. At the same time the Congressmen were again notified of our difficulties. On the same date we learned that none of the previous mining claimants had complied with the requirement of filing affidavits of labor by September first.

On September 10 we filed our own mining claim which in our opinion is now the only valid claim. We propose to obtain quit claim deeds from previous claimants to nullify any future action on their part.

On September 11th I delivered all necessary papers to the Custer Forest Service office and waited at that point until all papers were approved and ready for mailing to Denver.

On September 14 I called the Denver office and was told that their engineer could recommend issuance of the Permit at that point provided other staff members were satisfied. Congressman E. Y. Berry was notified and will take appropriate action today in an attempt to expedite the entire matter.

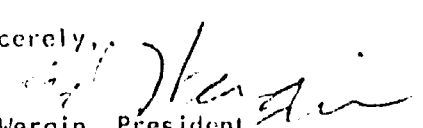
We have a proposal from Summit Construction Company for a cost plus contract with a maximum amount of \$56,000 for construction of the basic dam. The contractors are ready to begin construction upon one week's notice or less, and believe construction can be complete within six weeks.

I have not included all of our total costs involved in the project, but listed below you will find the major costs.

\$ 2,882.00	Staven Engineering fee for survey of the reservoir area, water permit application, and hearings.
\$ 5,255.68	Staven Engineering fee designing and specifications of original plan.
\$ 4,946.00	Staven Engineering fee redesigning of the dam.
\$ 900.00	Attorney's fees, land exchange, Special Use Permits, Forest Service contacts, etc.
\$ 1,200.00	Expenses for travel, telephone, postage, dealing with Forest Service.
\$ 3,850.00	Land cost. Forest Service has placed a valuation of \$350 per acre on the reservoir site with an 11 acre surface area.
<u>\$19,033.68</u>	Minimum amount already expended to build a \$56,000 dam.

We respectfully request that we be permitted to begin construction immediately upon receipt of Special Use Permit from the Forest Service. The date of January 26, 1956 to complete our entire system poses no problem.

Sincerely,


Ed Wergin, President
Black Hills Biltmore Corporation

EW:a

TO: Black Hills Biltmore Corporation
Rapid City, South Dakota

SUBJECT: Engineer's Construction Report
Water Supply System for the Black Hills Biltmore Corporation
Phase I: Construction of a dam, spillway, reservoir
Control piping and valves.

Work on Phase I of the above project was begun on October 11, 1962, by the Summit Construction Company, of Rapid City, South Dakota, hereinafter referred to as the Contractor. Construction staking for the contractor was handled by Mr. Leon Henry, a registered professional engineer and land surveyor, from centerlines and bench marks established on the ground by the Staven Engineering Company, of Rapid City, engineer for the owner, hereinafter referred to as the Engineer. This firm was represented on the job by V. L. Rugg, design engineer for the project.

The bed of the dam was stripped of trees, stumps, brush and sod and excavation of the core trench began. The material was dislodged by a Euclid C-6 bulldozer and the material was out-hauled by Euclid T-S-14 scrapers, with a D-8 push-cat assisting. The use of this heavy equipment made it desirable to excavate the core trench somewhat wider than the plan width to allow more efficient operation of the equipment and provide some margin for caving of the sides of the trench. The sides of the excavation, however, stood up fairly well during the comparatively short time the trench was open. As a result, the clay core of the dam was built somewhat thicker than plan.

Core trench excavation was slowed materially by numerous firmly bedded boulders too large to be picked up by the scrapers. These were bunted out by bulldozers and deposited outside the toes of the embankment, the bulk of them being placed between the downstream

toe of the embankment and the spillway tailrace channel.

The surface of the exposed bedded schist proved to be very irregular and rough with a sharp inclination to the east (downstream), especially between Stas. 2+00 and 3+00. This inclination reached a maximum at Sta. 2+78 where it dipped from El. - 25.9 on the upstream side to El. - 18.9 on the downstream side of the trench. Between former test holes located approximately in the dam centerline at Stas. 2+30 and 3+44, the bedded schist dipped deeply. These characteristics may be seen in the "as built" centerline profile and core trench cross sections.

At Sta. 0+45 the bedded schist line, at El. - 38.1, began to slant more deeply into the south abutment, the surface of which rises quite sharply. When the slope of the south end of the cut became too steep for the bulldozer to climb, a cross trench was cut about 15' deep thru broken schist and clay and graded steeply downward to form a longer approach ramp. When this, in turn, became too steep a front-end loader was used to excavate this end of the trench to a near-vertical face. This appeared to be as far as it was possible to go with the equipment available.

It was recognized that some percolation loss could be expected thru the abutment beyond the end of the clay core. The factors of soil types and depths, length of travel and probable head losses in the percolating water were carefully considered. Any percolating water would become widely diffused in sand and gravel deposits before surfacing in the stream again some 300 feet downstream from the dam, and would pose no threat to the stability and safety of the structure.

It was decided that such percolation loss would be well within tolerable limits and that the expense of bringing in different equipment to drive the core deeper into the abutment would not be economically justified.

The surface of the exposed schist was cleaned of all significant amounts of granular material or weathered schist by hand labor before the first thin contact lift of dense, plastic clay was laid down on it. Between Sta. 2+15 and Sta. 2+58 the exposed schist was fractured and splintered by the heavy equipment to a greater extent than elsewhere in the cut, although when the loose material was removed the bedding planes appeared to be tight.

However, it was recommended that four grout pipes be installed at Stas. 2+18, 2+30, 2+42 and 2+54 in the event that this "fracture zone" may be due to some weakness in the formation which may require grouting at some future time. The pipes to be of 1 1/2" wrought iron pipe drilled a foot into the schist and sealed into the embankment in the same manner as a cemented well casing. The pipes, brought to the top of the dam and capped, would serve as sounding wells, giving advance notice of trouble or excessive leakage, if such should ever develop in this zone, and providing means of grouting this zone without delay, in such case. It was agreed that this could be done more economically and safely after completion of the embankment, due to the hazards of possible damage to the pipes by heavy equipment and the difficulty of keeping adequate compaction around the pipes.

The design called for the 12" reservoir control line and the 6" supply line to pass thru the dam at Sta. 3+10. However, due to an abrupt

pocket in the schist at this station the pipes were shifted to cross the centerline of the dam at Sta. 3+32. The inlet box for the 12" control line was set 159.6' left of Sta. 3+00, well outside the upstream toe of the dam, and the outlet end was set as close to design location as feasible with the pipe and fittings available; the center of the downstream 12", 22 1/2-degree bend being set 116.3' right of Sta. 2+98. Regular 45-degree bends were placed in the pipes immediately downstream from the centerline cutoff wall and encased in concrete.

This alinement permitted a good bedding contact with the schist thru the concrete embedment zone which extends 72' upstream and 20' downstream from the centerline cutoff wall, the depth of concrete under the pipes ranging from about 2" to over 12". The bottom of the cutoff walls were cut 4" to 8" into the schist; the walls being poured after the pipe was laid and bedded. Outside the concreted zone, the pipes were bedded on compacted earth, sand, or sand-gravel mixture, found in place. The pipe trench was backfilled with choice clay delivered to the side of the trench, spread by hand in 6" to 8" lifts and compacted with pneumatic tampers to a height of about one foot above the cutoff walls, after which compaction was done by sheepsfoot roller and passage of loaded scrapers.

Meantime, the core trench had been backfilled with choice clay to approximate stripped dam bed elevation, the lifts being compacted by sheepsfoot roller and passage of loaded scrapers. The trench was wide enough to allow staggering the track of the incoming loaded scrapers and uniformly good compaction was obtained. Another bulldozer or motor patrol combed out any objectionably large stones brought in from the borrow pit and pushed them outside the embankment area. The clay had enough moisture content to render it plastic

(15% - 18%) and occasional smaller stones were readily absorbed under rolling.

The clay core was brought along to approximately Sta. 3+60 and sloped toward the creek channel. All boulders were removed from the stream bed between the upstream and downstream toes, most of them being deposited between the downstream toe and the spillway tail-race channel. A small dike was thrown across the stream below the screened inlet for the reservoir control line and the stream flow was diverted thru this 12" line, which flowed about half full at the inlet end, indicating a flow of approximately 550 GPM.

All material was excavated from the stream bed to hard bedded schist for a width of about 40' at the core zone. At point of contact with the granite spire forming the north abutment of the dam, the bedded schist was exposed, about 20' wide, all the way around the upstream nose of the spire to its contact face with the schist on the back (north) side of the spire and for 25' east (downstream) from the dam centerline, the final cleaning of the bedrock being done with hand labor. The excavation on the south bank of the stream was carried back into previously placed clay core material. Contact faces between the granite spire and the schist appeared uniformly tight and sound thruout the exposed contact line.

Excavation, in this closure area, had been done in a manner to allow operation of the equipment transversely to the dam centerline, or parallel to the north abutment and stream channel. Each lift of clay was thoroughly compacted by sheepsfoot roller and passage of

loaded scrapers. The plastic clay was compacted in thin lifts against the face of the cliff by continuous rolling with the wheels of a D-12 motor patrol, the front wheels slanted outward and the blade being used to obtain side thrust. Pneumatic tampers were used in the small pocket on the north side of the upstream nose of the granite cliff, where inaccessible with heavy equipment. Previously deposited clay core material was pushed into and bonded with each lift.

When the embankment reached an elevation where the seams in the granite north abutment could be reached without the construction of staging, these seams were sealed, pneumatically applied mortar (jetcrete) being used for this purpose. The seams of the granite, and the face of the granite for a minimum 12" each side of the seams, were raked out, then blown out with a high pressure air line and thoroughly sandblasted with coarse silica sand. The rebound sand was then blown out and the larger seams filled as deeply as feasible (18" to 30") with Type I Portland cement jetcrete to within about 6" of the face of the cliff. The mix was then switched to Type III (high early strength) cement, which was used to finish out the seam and surface bond zone. "Embeco", a non-shrink admixture was used in varying proportions according to the width or thickness of the seam being filled.

Fortunately the weather was very mild during this operation, the coldest night temperature recorded at the site being 42°F. However, for safety, the temperature on the face of the cliff was kept at 65° to 69° with a large, blower-equipped space heater. After 24 hours the jetcreted seams were examined for evidence of slump, shrinkage or freezing, but none was found and the surfaces were cleared for placement of embankment material.

As a measure of economy, the Owner decided to construct in Phase I only such plant as would be necessary to impound and control water: the dam, spillway, infiltration gallery and 6" water supply line, the 12" reservoir control line with screened inlet box and such valves as would be required to shut off, or to draw water from, either or both lines. To this end, the 12" line, with both 12" valves, was laid in its entirety to point of discharge downstream (See sheet 18 of plans). The 6" valve in line from the gallery and the 6" valve in the line interconnecting the gallery with the 12" control line were installed, together with the 6-6-6-4 cross connecting these two 6" valves. The east and south outlets of this cross were fitted with blank flanges. A 4", 1/4-turn cock was installed in the 4" line by-passing the downstream 12" valve. The meter was not installed at this time. This valve assembly was enclosed in a wooden box about 10' x 14" in size filled with sawdust to approximately 30" above the valve hand wheels. Both 12" valves, the interconnecting 6" valve, and the 4" regulating cock were equipped with valve stem extensions. It was recommended to the Owner that only the downstream 12" valve be closed; all other valves to be open and the 4" cock opened slightly to induce some motion of water in the lines to minimize danger of freezing in severe sub-zero weather.

In the approved plans, the spillway embodied a 12' wide drop, or nappe section in open cut, changing to a steeply graded tunnel section discharging in open cut downstream. The design head at full flood stage was eight feet, leaving a 2-foot residual freeboard

on the dam. A pre-construction survey and estimate was begun, the following features being flagged on the ground for inspection and measurement: toes of the dam, infiltration gallery, pipelines and pump house location.

Before the route of the tunnel type spillway was flagged upon the ground for actual site inspection the Owner, for reasons deemed to be practical and sufficient, authorized an alternate plan to be prepared, whereby all construction would be contained on private land currently the property of the Owner. In view of this, the actual flagging and site inspection of the route of the spillway was not completed at that time.

In September, 1962, the Owner decided to proceed according to the original plan and on September 25, 1962, engineers of the U. S. Forest Service and Staven Engineering Company conferred to review the plans and specifications and determine the nature of the additional data to be furnished for review and approval by the U. S. Forest Service. Very shortly after approval by that agency, the Owner negotiated a contract for the construction with the Summit Construction Company.

The Contractor proposed to construct the spillway entirely in open cut. The Engineer advised the Owner that the spillway study had been approached at first from the standpoint of open cut design, but that the drop section-and-tunnel combination had been adopted because of the estimated prohibitive cost of the open cut type. The Engineer was requested by the Owner to prepare plans for an open cut spillway so that cost estimates and bids for each type could be secured.

The route of the spillway, as shown in the plans, was immediately flagged upon the ground and inspected by engineers of the Staven Engineering Company. From data gained during excavation of the core trench, supplemented by preconstruction test hole data, it appeared that in some time past, the course of the stream had been such as to induce a vortex, with consequent scooping out of the weathered schist stream bed, at the point where the high velocity flow from the tunnel, as staked, would break out into open cut near the downstream toe of the dam. In the opinion of the engineers this would constitute a substantial menace to the stability of the downstream toe of the dam.

It was decided to open up the angle between the spillway and dam centerlines to swing the route of the spillway further north where the high velocity flow, from either tunnel or open cut, would impact directly against the solid rock wall of the tailrace channel cut. Energy dissipation and directional change will be contained in solid rock excavation and the tailrace channel will discharge on a line colinear with the downstream reach of the existing creek channel.

An open cut spillway was then designed. To keep the grade line as high as feasible and minimize the difficulty of getting thru the deepest cut, the entrance channel was based on a cut with 16' bottom width, and 1/4:1 side slopes, flowing at a depth of 6'. Initial velocity was to be obtained by a 2' drop at a 2:1 slope over a concrete sill near the channel entrance and the balance of the channel was graded downward at - 1% to the curve and at - 2.5% around the curve to maintain design flood flow without increasing the design flood

crest at the entrance. At the P. T., the bottom width was narrowed to 12' at -2% grade. From the tailrace channel cut, the grade would slope upward as steeply as the equipment could economically operate (30% to 40%) to intercept the -2% grade.

After studying the spillway plans, the Contractor made the Owner a proposal to construct an open cut spillway which was accepted by the Owner and work was started immediately. Mr. Leon Henry, engineer for the Contractor, requested permission to stake the entire cut at a 16' bottom width, in the interest of easier control and the Engineer concurred with that request.

The embankment of the dam was blue-topped for finishing the shoulders on November 13, 1963. The fill was constructed to El. -4471, allowing 1.0', or about 2 1/2% of maximum height, for possible future settlement. At about El. -4454 a portion of the north abutment cliff had a slight overhang for part of the horizontal contact distance. When the overhang section no longer allowed the face of the rock to be rolled with heavy equipment, the fill material was compacted at an angle of about 45° under the overhang with pneumatic tampers and the fill carried outward at this slope until clear of the overhang section.

Some settlement of the material under the overhang section will inevitably occur and to compensate for this a 1 1/2" mud-jacking pipe was installed and capped. This pipe leads from above the top of the dam down to, and under, the overhang section, terminating in a tee with short stubs pointing upstream and downstream. It is

recommended that the Owner, as a matter of preventive maintenance, mud-jack this zone at least once a year with a semi-fluid mixture of water and choice clay to a head-gauge pressure of 50 p. s. i., or until evidence of clay extrusion becomes visible at the upstream contact face between the embankment and the abutment, the downstream face being covered with waste rock from the spillway excavation. The first intrusion of clay should be allowed to rest for 48 hours and the process repeated. This should be done annually until the zone refuses to accept clay at 50 p. s. i. pressure without extruding, when ultimate settlement may be presumed to have been reached.

A mixture of gravel and sand was excavated from the reservoir basin some 400' upstream from the dam and spread in a 4" to 6" thick layer on the upstream surface of the dam to serve as a bedding cushion for the riprap which consisted, for the most part, of rock excavated from the spillway cut.

The borrow areas chosen at the time the plans were prepared were largely within the natural reservoir basin, or that basin as enlarged in a tributary valley by borrowing below maximum pool level. Test pits in these areas, after a long series of dry years, showed no trace of water at that time. Heavy precipitation of record proportions occurring during the spring and summer of 1962, surcharged all shallow aquifers and created such boggy conditions in much of the intended borrow area that it could not be used to the extent planned due to miring of the heavy equipment. Therefore, it was necessary to borrow from sources higher in the tributary valley where conditions permitted operation of such equipment.

As the borrow areas were developed it became apparent that more good, dense clay would be available at this site than had been estimated from the test pit findings. The auxiliary clay borrow area, about one mile distant, was stripped, to be ready if needed. Random grab samples from this source were found to be quite dry but, after admixture of water, equally as dense and plastic and suitable for core material as that found at the reservoir site.

By skillful operation of the borrow areas sufficient impervious material was obtained in and near the reservoir basin to complete the dam without hauling and watering any material from the mile distant auxiliary supply. Much credit for this is due Mr. Don Darrow, the Contractor's foreman, for his good judgment of soil types and efficient operation of the borrow areas.

During excavation of the spillway cut, the job was inspected periodically by the Engineer. Considerable difficulty was experienced with falling of inclined slabs, especially in the south wall of the cut. At the point where the initial drop in the bed of the cut was planned the schist was found to be too weathered and soft for this to be feasible and it was decided to put this drop, with its concrete sill at El. - 4460, further downstream where the rock was sound and tight. At a point where the designed bottom width could not be attained without endangering the south wall of the cut, additional depth was to be excavated to give equivalent channel cross section.

The "as built" reservoir basin survey was completed and the storage capacity determined. It was found that, due to inability to utilize

much of the planned borrow areas, it would be necessary to raise the maximum pool level 1.5 feet to get the designed storage capacity, using a concrete overflow weir. Flash boards would be used if the approving agencies desired to maintain the full available freeboard of 10 feet.

On January 2, 1963, the Engineer inspected the job and found work still in progress. Mr. Henry, the Contractor's engineer, advised that some excavation remained to be done in the bed of the cut and the notch for the concrete sill. He was advised that flash boards or a concrete weir would be installed to raise the maximum pool level to El. - 4461.5 if approval for this could be obtained from the Chief Engineer of the State Water Resources Commission and the U. S. Forest Service.

On January 7, 1963, the Engineer contacted Mr. J. W. Grimes, Chief Engineer for the State Water Resources Commission, explaining the situation on the project and requesting permission to raise the maximum pool level to El. - 4461.5, Mr. Grimes granted such permission orally, in view of the conditions. The Engineer then went to the job site to flag the upstream limit of the reservoir, if filled to El. - 4461.5. Work on the spillway excavation had been terminated and the equipment had been removed from the site.

On January 9, 1963, the job was inspected by the following party: Mr. Ed Wergin, president of the Black Hills Biltmore Corporation, Owner; Mr. John Mead, of Denver, Colorado and Mr. Francis Freeland of Custer, South Dakota, engineers for U. S. Forest Service:

Mr. Leon Henry, Contractor's engineer and V. L. Rugg, representing the Engineer for the Owner. The question of ogee weir v. s. flashboards was discussed and the ogee type concrete weir approved. Upon return to Rapid City, Mr. Mead and Mr. Rugg conferred at length relative to the submission of "as built" plans and Engineer's report. Mr. Mead stated that he would approve any ogee weir of such shape and height that, at full flood flow of 945 CFS, there would remain a residual 3 feet of freeboard on the dam. In other words, the maximum reservoir level at full design flood stage, must not exceed El. 4467.0.

The "as built" survey of the spillway cut, made shortly thereafter, indicates that, in its present status, it would not be able to carry the design maximum flood of 945 CFS without encroaching dangerously on the residual freeboard of the dam. No grade has been given the bed of the cut from its entrance, as designed, to carry this flow without increasing the design flood level of the reservoir, nor has additional depth of cut been made at points of restricted width to give a channel cross section equivalent to that designed. The cross sections from Sta. 0+00 to Sta. 0+33 were much greater than the design cross section.

Analysis of the channel cut was made in successive reaches of average 15' length each from Sta. 0+33 downstream and the required drop to carry flood flow thru each reach was determined. It was found that, to carry the flow from Sta. 0+33 to Sta. 1+35, where the 2:1 sloping drop of 2 feet is started, the bed of the channel with present cross sections should have been cut to El. - 57.3 at Sta. 1+35, or an average grade of approximately - 2.65%. Conversely, with the present cut un-modified, the pool level would have to raise to El. - 69.7 to push the flood flow to Sta. 1 +35. The designed top of the dam is at El. 70.0 altho it was constructed to El. - 71.0 to allow for settlement.

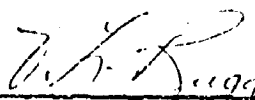
Studies were made of the feasibility of constructing a nappe-shaped weir, having a discharge capacity of 945 CFS or more with pool El. - 67.0, at Sta. 0+33 where a crest width of 20' would be available at El. - 61.5. However this was discarded because of the difficulty

of sealing it into sound rock and the large amount of excavation downstream necessary to cancel out backwater effect. In view of the existing conditions, it is recommended that the following be done to obtain a full reservoir level at El. - 61.5 and to enable a full flood flow of 945 CFS to be handled with maximum pool level at El. - 67.0:

1. Cut the bottom of the present spillway channel to a grade of - 2.65% from Sta. 0+33 to Sta. 1+33.
2. Construct a nappe-shaped weir at Sta. 1+35 with the crest at El. - 61.5. At this point a crest length of 17 feet may be obtained and the 2:1 slope of the bed of the cut at this point will facilitate construction with the least amount of rock excavation and concrete. Downstream from the apron of the weir at Elv. - 58.4, trim the bed of the cut to a - 1.3% grade, to daylight in the steep slope downstream at approximately Sta. 1+90. The quantities required to accomplish this are estimated to be approximately 80 C.Y. of rock excavation and 12 C.Y. of reinforced concrete.
3. If the pool level is to be maintained at El. - 61.5 for an appreciable period, the south wall of the spillway cut from the weir to the entrance should be given a minimum 1" coat of jetcrete to El. - 62.0 to minimize saturation of the fractured rock formation with consequent maintenance troubles due to cycles of freezing. This should be applied on welded wire fabric, approximately 4 x 4-10-10, stapled to the rock wall.

4. A cross section of the proposed weir, of 17' crest length, is attached hereto. It is designed for a maximum 5.5' head, and an approach velocity of 10 feet per second, with the upstream face sloped 2:3.

Respectfully submitted,
STAVEN ENGINEERING COMPANY

By 
V. L. Rugg, P. E.

Date: February 1963

57702

November 7, 1963

Mr. Ed Wergin, President
Black Hills Biltmore, Inc.
1915 Elmhurst
Rapid City, South Dakota

Dear Sir:

In accordance with our agreement dated July 6, 1961, we are to furnish engineering services and serve as your professional representative during the planning and construction of your project.

Although no actual construction work has been done for some time, we are still bound by contract to protect your interests.

We, therefore, are contractually and professionally obligated to make an inspection of the dam, spillway and related piping and valves to determine the conditions existing which may pose a threat to the safety of the facility as well as to the safety of the public and property located down stream from the construction site.

Since some time has lapsed since we have provided any service to you, we hereby request that you inform us in writing that you realize both your and our obligations of the Agreement and that you instruct us to proceed immediately with an inspection and report of existing conditions.

It is most urgent that this inspection take place prior to continued freezing weather and prior to winter and spring loading of the dam structure.

Very truly yours,

STAVEN ENGINEERING COMPANY

D. H. Hedin
Chief Engineer

DNH:jm

December 17, 1963

U. S. Forest Service
Rocky Mountain Region
Bldg. 85, Denver Federal Center
Denver 25, Colorado

Attn: Mr. John Mead

RE: 2710 (5600)

Gentlemen:

On Jan. 9, 1963, an inspection was made of the Black Hills Biltmore Dam, constructed under a special use permit issued by the U. S. Forest Service; the inspection being made by Mr. John Mead, together with engineering personnel of the Owner and Contractor. Shortly thereafter, the as constructed survey indicated some additional work would have to be done in the spillway cut to bring the construction to what we would consider "satisfactory compliance" with the design concept. This additional work was detailed in the Engineers Construction Report which was personally delivered to, and discussed with, Mr. Ed Wergin, president of the Black Hills Biltmore Corporation. An information copy of this report was sent to Mr. John Mead, U.S.F.S., under letter of March 29, 1963.

The lake filled quite rapidly during heavy snow melt in latter March. Strong runs thru the spillway occurred frequently during heavy rains in May and June. On June 17, two engineers of this firm sounded the mud-jacking pipe installed at the north abutment where the cliff has an overhang at approximate Elev. 54.3. (Described on Page 10, Engineer's Report.) Water stood at Elev. 59.2 in the pipe, very nearly the original full pool Elev. 60. Mr. Wergin was immediately notified by phone, and by letter dated June 18, 1963, that the reservoir should be lowered at least to Elev. 53 and kept there, if possible, until the probable void due to settlement under the cliff overhang had been filled by mud-jacking with bentonite-clay mixture, which should be done without delay. Also, that "the grout pipes recommended on Page 3 of the Engineer's Construction Report be installed as the first order of business when construction is again resumed on the project."

U. S. Forest Service
December 17, 1963
Page 2

Mr. Wergin was again warned by this firm, in a letter dated June 25, 1963, that a serious condition had developed at the dam, the letter stating, in part:

"We urgently recommend that repairs to the structure, as well as to the spillway, be commenced immediately to reduce the possibility of failure of the dam. If you elect to ignore this problem, we will deem it necessary to notify the National Forest Service and the South Dakota Water Resources Commission that an emergency exists-----, As Professional Engineers, we are pledged to the safeguarding of the public welfare. We would be breaching this pledge if we did not notify public authorities of the pending danger.-----"

"Please be advised that all recommendations made by our firm in reports, and verbally, were sincere and based on professional study. We, therefore, ask that you rely on our judgement in order that your investment and the public safety be protected."

It was noted thereafter that the lake level had been drawn down as recommended. However, on July 5 the water was back to within a foot of the spillway. A formerly wet area low on the downstream slope of the dam, at the north end, was drying up. Several small seeps were noted in the gravel creek bank about 115 feet south of the outlet pipe and 100 feet east of the downstream toe of the dam, but there was nowhere any evidence of material being moved. (Sand boils.) The downstream toe of the dam, other than the spot noted, was dry. To the best of our knowledge, no corrective work recommended by this firm has been done to date.

On November 7, 1963, our professional concern for this project was set forth in a letter to Mr. Wergin, a copy of which is enclosed. We have received no reply, written or oral, to this letter. We are, therefore, moved to take steps in accordance with the canon of ethics of a professional engineer wherein:

"He will regard his duty to the public welfare as paramount."

And again: "He will guard against conditions that are dangerous or threatening to life, limb or property on work for which he is responsible, or if he is not responsible, will promptly call such conditions to the attention of those who are responsible".

Therefore, we advise you with regret that this firm will assume no further responsibility as consulting engineer for this project, since the Black Hills Biltmore Corporation either will not, or can not,

U. S. Forest Service
December 17, 1963
Page 3

implement the measures we believe to be essential to the safety of the installation.

Very truly yours,

STAVEN ENGINEERING COMPANY

By: V. L. Rugg

V. L. Rugg, P. E.

YLR:jm

Enclosure

CC: John Mead
J. W. Grimes
B. H. Biltmore

C
O
P
Y

Permit No. 563-2Water Division 2 BATTLE CREEK Water District

REPORT OF EXAMINATION OF WORKS AND/OR APPLICATION OF WATER TO BENEFICIAL USE

TO: Water Resources Commission, State Office Building No. 2, Pierre, South Dakota 57501

I have this day made a thorough examination of the water use system constructed by Dakota West
Corporation of Huron, South Dakota holder
 of Permit No. 563-2, bearing date of priority of December 1 19 59
 authorizing the diversion of .668 cu. ft. per second of the waters of Iron Creek
 for Irrigation and recreation purposes, in Buster County.

I have to report on the condition of the same as follows:

The Water Use System consists of,

A. Works used to divert the water:

Earth Dam: 404 ft. long
40 ft. deep

The spillway consists of a channel cut through rock, left abutment with capacity of
 1200 + c.f.s.

B. Works used to transport water to place of use,

Stored water used for recreation purposes only

Surface area 109 acres

Volume at spillway level - 115.2 Acre Feet

C. Works used to apply water to beneficial use.

The system is in the following condition: very good

The point of diversion is located 1177 feet S. 43°05' East from NW Corner, of Section
27, T2S, R6E

The works are capable of diverting and conveying to the place of use
 Stored water volume of 115.2 Acre-feet is used for recreation purposes only

XX
 cu. ft. per second of water which is to be used for

Water has been put to beneficial use to the maximum extent as follows:

The name of the lake formed by the dam is Biltmore Lake and this lake has been
used for recreation purposes only since construction was completed in 1963.

XX
 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

Date May 4, 1970

Donald Driscoll
 (Signature)

X DONALD DRISCOLL, Dept. Chief Engineer
 Water Resources Commission

NOTICE OF TRANSFER OF WATER PERMIT

TO: Water Resources Commission
 State Office Building No. 2
 Pierre, South Dakota 57501

Date MAY 14, 1970

This is to notify you that title to the lands described as follows:

H.E.S. 419, Sections 27 and 28, T2S, R6E

formerly owned by Dakota West Corporation

has been transferred to United States of America for administration by Forest Service, U. S. D. A.

together with any rights to the beneficial use of water thereon as evidenced by Water Right Permit No. 563-2 as provided for in Section 61.0127 of the 1960 Supplement to the South Dakota Code of 1939.

You are therefore hereby requested to file this "Notice of Transfer of Water Permit" in its appropriate file at the Office of Water Resources Commission as evidence of the change of ownership.

A fee of one dollar is hereto attached to cover filing fees as required under Section 61.0159 of the 1960 Supplement to the South Dakota Code of 1939.

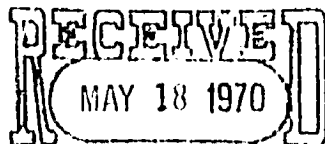
STATE OF SOUTH DAKOTA)
 County of Custer) ss.

I, Larry L. Hall being first duly sworn on my oath depose and say: ~~I am a resident of the above described land and am the owner thereof~~ that I have read the above foregoing statement, and I know of my own personal knowledge that the information herein stated is true.

Larry L. Hall
 (Signed)

Suscribed and sworn to before me this 14th day of May, 19 70

Edna M. Larson
 (Notary Public)
 Clerk of Courts, Custer County, S. Dakota



STATE WATER RESOURCES COMMISSION
 PIERRE, SOUTH DAKOTA

SPECIFICATIONS FOR
BLACK HILLS BILTMORE
WATER SUPPLY SYSTEM

Staven Engineering Company
Rapid City, South Dakota

November, 1961

SECTION 1.1
ADVERTISEMENT

1.1.01 RECEIPT OF PROPOSALS: Sealed Proposals on forms prepared by the Engineer will be received by The Black Hills Biltmore Corporation
at Rapid City, South Dakota
until _____ (local time) on _____ 19____
for the construction of a water supply system

for The Black Hills Biltmore Corporation
at the project site in Section 27, T2S, R6E, B.H.M.
in accordance with Drawings, Specifications and other Contract Documents prepared by _____
Staven Engineering Company, Rapid City, South Dakota

1.1.02 PROPOSALS WILL BE PUBLICLY OPENED AND READ at _____ (local time) on _____
19____ at _____

1.1.03 OBTAINING CONTRACT DOCUMENTS: Drawings, Specifications and other Contract Documents may be obtained upon application at the office of _____
after _____ on _____ 19____
upon the payment of a deposit of \$15.00 per set. The deposit shall be in check form and shall be

drawn payable to The Black Hills Biltmore Corporation
The deposit for each set will be refunded upon return of the Contract Documents in good condition not later than seven (7) days following the opening of Proposals.

1.1.04 PROPOSAL GUARANTY: Each Proposal shall be accompanied by an acceptable form of Proposal Guaranty in an amount equal to at least five (5) per cent of the amount of the Proposal payable to

The Black Hills Biltmore Corporation
as a guaranty that if the Proposal is accepted, the Bidder will execute the Contract and file acceptable Performance and Labor and Material Payment Bonds within ten (10) days after the award of the Contract.

1.1.05 OWNERS RIGHTS RESERVED:

The Black Hills Biltmore Corporation
hereinafter called the Owner, reserves the right to reject any or all Proposals and to waive any formality or technicality in any Proposal in the interest of the Owner.

SECTION 1.2 INFORMATION FOR BIDDERS

1.2.01 PROPOSALS are requested for the construction of a water supply system

for The Black Hills Piltmore Corporation, Rapid City, S. D.

at the project site in Section 27, 12S, R6E, B.H.M.

in accordance with Drawings, Specifications and other Contract Documents prepared by _____

Staven Engineering Company, Rapid City, S. D.

a. **Form:** Each Proposal shall be made on a form prepared therefor by the Engineer and included as one of the Contract Documents, and shall be submitted in a sealed envelope bearing the title of the work and the name of the Bidder.

b. **Discrepancies:** In case of a difference between the stipulated amount of the Proposal written in words and the stipulated amount written in figures, the stipulated amount stated in written words shall govern.

c. **Modifications:** Proposals shall not contain any recapitulations of the work to be done. Alternate proposals will not be considered unless called for. Oral proposals or modifications will not be considered.

d. **Examination of Contract Documents and Visit to Site:** Before submitting a Proposal, Bidders shall carefully examine the Drawings, read the Specifications, and the other Contract Documents, shall visit the site of work, and shall fully inform themselves as to all existing conditions and limitations, and shall include in the Proposal a sum to cover the cost of all items included in the Contract Documents.

e. **Delivery of Proposals:** Proposals shall be delivered by the time and to the place stipulated in the Advertisement. It is the sole responsibility of the Bidder to see that his Proposal is received in proper time. Any Proposal received after the scheduled closing time for receipt of Proposals shall be returned to the Bidder unopened.

f. **Withdrawal:** Any Bidder may withdraw his Proposal, either personally or by telegraphic or written request, at any time prior to the scheduled closing time for receipt of Proposals.

g. **Opening:** Proposals will be opened and publicly read aloud at the time and place set forth in the Advertisement.

h. **Award or Rejection:** The Contract will be awarded to the lowest and/or best qualified responsible Bidder complying with these instructions and with the Advertisement. The Owner reserves the right to reject any or all Proposals or to waive any formality or technicality in any Proposal in the interest of the Owner. No Bidder may withdraw his Proposal for a period of 30 days after the date of opening thereof.

1.2.02 **INTERPRETATION OF DOCUMENTS:** If any person contemplating submitting a Proposal is in doubt as to the true meaning of any part of the Drawings, Specifications or other Contract Documents, or finds discrepancies in or omissions from the Drawings or Specifications, he may submit to the Engineer a written request for an interpretation or correction thereof. The person submitting the request will be responsible for its prompt delivery. Any interpretation or correction of the documents will be made only by Addendum duly issued and a copy of the Addendum will be mailed or delivered to each person receiving a set of the Contract Documents. Neither the Owner nor the Engineer will be responsible for any other explanations or interpretations of the Contract Documents.

1.2.03 **ADDENDA:** Any addenda issued during the time of bidding, or forming a part of the Contract Documents loaned to the Bidder for the preparation of his Proposal, shall be covered in the Proposal, and shall be made a part of the Contract. Receipt of each Addendum shall be acknowledged in the Proposal.

1.2.04 **BIDDERS INTERESTED IN MORE THAN ONE PROPOSAL:** No person, firm, or corporation shall be allowed to make, file or to be interested in more than one Proposal for the same work, unless alternate Proposals are called for. A person, firm, or corporation who has submitted a subproposal to a Bidder, or who has quoted prices on materials to a Bidder, is not hereby disqualified from submitting a subproposal or quoting prices to other Bidders.

1.2.05 **PROPOSAL GUARANTY:** Each Proposal shall be accompanied by a certified check or bid bond acceptable to the Owner, in an amount equal to at least 5% of the Proposal, payable without condition to the Owner as a guaranty that the Bidder, if awarded the Contract, will promptly execute the Agreement in accordance with the Proposal and the other Contract Documents, and will furnish good and sufficient bond for the faithful performance of the same, and for the payment to all persons supplying labor and material for the work. The Proposal Guaranties of all Bidders except the three lowest will be returned promptly after the canvass of Proposals.

1.2.06 **PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND:** The successful Bidder, simultaneously with the execution of the Contract, will be required to furnish a faithful Performance Bond in an amount equal to one hundred per cent, (100%) of the Contract Amount and a Labor and Material Payment Bond equal to fifty per cent (50%) of the Contract Amount; said bonds shall be secured from a surety company satisfactory to the Owner. The forms of the Bonds the successful Bidder will be required to execute are included in the Contract Documents.

1.2.07 ~~WAGE SCALE: The Contractor shall conform to the "General Existing Wage Scale," currently in effect, as prepared by the~~ Omit this paragraph
of _____

1.2.08 **GENERAL CONDITIONS OF THE CONTRACT** (latest edition) copyrighted by Consulting Engineers Council, Springfield, Illinois, as bound hereinwith, are hereby made a part of the Contract Documents.

1.2.09 Any Bidder may submit a bid on either or both of two alternates, as follows:

Alternate No. 1: The construction included in SECTIONS A, B-1 and C-1 of the SCHEDULE OF BID ITEMS.

Alternate No. 2: The construction included in SECTIONS A, B-1, B-2 and C-2 of the SCHEDULE OF BID ITEMS.

If the Bidder submits bids on both alternates, the amount of the Proposal Guarantee shall be based on the larger of the two bid amounts.

SECTION 1.3
PROPOSAL

1.3.01 THE FOLLOWING PROPOSAL IS HEREBY MADE TO:

The Black Hills Biltmore Corporation
OWNER

BUSINESS ADDRESS

Rapid City South Dakota
CITY STATE

1.3.02 STIPULATED AMOUNT: The Undersigned hereby proposes and agrees to furnish all the necessary labor, materials, equipment, tools and services necessary for the construction of _____
a water supply system

for The Black Hills Biltmore Corporation
at the project site in Section 27, T2S, R6E, B.H.M.

all in accordance with the Drawings, Specifications and other Contract Documents prepared by _____
Staven Engineering Company, Rapid City, South Dakota

_____ for the following stipulated amount:
shown on Page 1.5d of "SCHEDULE OF BID ITEMS" Dollars (\$ _____).
as bound herewith.

1.3.03 KNOWLEDGE OF LOCAL CONDITIONS AND CONTRACT DOCUMENTS: The Undersigned has examined the location of the proposed work, the Drawings, Specifications and other Contract Documents and is familiar with the local conditions at the place where the work is to be performed.

1.3.04 PROPOSAL GUARANTY: The Proposal Guaranty attached, without endorsement, in the sum of not less than five per cent (5%) of the amount of the Proposal, is furnished to the Owner as a guarantee that the Agreement will be executed and a Performance Bond and a Labor and Material Payment Bond furnished within ten (10) days after award of the Contract to the Undersigned, or that the Undersigned will pay to the Owner the difference between the stipulated amount of this Proposal and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by this Proposal, provided that such payment shall be limited to the amount of the Proposal Guaranty.

1.3.05 EXECUTION OF AGREEMENT AND FURNISHING BONDS: Within ten (10) days after being awarded the Contract, the Undersigned agrees to execute the form of Agreement included as one of the Contract Documents, and to furnish a Performance Bond in an amount equal to 100% of the Contract Amount, and a Labor and Material Payment Bond in an amount equal to 50% of the Contract Amount.

1.3.06 ADDENDA: The Undersigned hereby acknowledges receipt of the following Addenda:

Addendum No.

Dated

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

1.3.07 CONTRACT TIME: If awarded the Contract, the Undersigned agrees to complete the work within _____ calendar days of the commencement of the Contract Time as defined in the General Conditions of the Contract.

1.3.08 OWNER'S RIGHTS RESERVED: The Undersigned understands that the Owner reserves the right to reject any or all Proposals or to waive any formality or technicality in any Proposal in the interest of the Owner.

1.3.09 THE ABOVE PROPOSAL IS HEREBY RESPECTFULLY SUBMITTED BY:

CONTRACTOR _____

BY _____

TITLE _____

BUSINESS ADDRESS _____

CITY _____

STATE _____

DATE _____

SCHEDULE OF BID ITEMS

ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE		AMOUNT
				WRITTEN AMOUNT	FIGURES	
	<u>SECTION A: DAM & SPILLWAY</u>					
1.	Dam site clearing & grubbing	Lump	Sum			
2.	Common excavation	10,750	C.Y.			
3.	Core trench backfill, in place	3,800	C.Y.			
4.	Dam embankment, in place	39,600	C.Y.			
5.	Clay overhaul	6,000	C.Y.			
6.	Pipe lines at dam					
a.	12" cast iron pipe, Class 150, M-J	304	L.F.			
b.	6" cast iron pipe, Class 150, M-J	384	L.F.			
c.	3/8" O.D. copper water tube, Typek	315	L.F.			
d.	12" perforated V.C. pipe	120	L.F.			
7.	Spillway					
a.	Rock excavation, open cut	233	C.Y.			
b.	Rock excavation, tunnel	253	C.Y.			
c.	Trash rack	Lump	Sum			
8.	Riprap in place	883	C.Y.			
9.	Embankment seeding	Lump	Sum			
10.	Pump house, structural	Lump	Sum			

SCHEDULE OF BID ITEMS

ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE		
				WRITTEN AMOUNT	FIGURES	AMOUNT
11.	Pumps, pump controls & switchgear	Lump	Sum			
12.	Chlorinator	Lump	Sum			
13.	4" flanged tube meters	2	Each			
14.	Miscellaneous pump house valves, piping & equipment	Lump	Sum			
15.	Parshall Flumes	2	Each			
	SUBTOTAL, SECTION A					
	SECTION B: SUPPLY PIPE LINE					
1.	From pump house to Tank Site					
	No. 1					
a.	6" cast iron pipe, Class 200, M-J	1,648	L.F.			
b.	6" asbestos-cement pipe, Class 200	780	L.F.			
c.	6" cast iron pipe, Class 150, M-J	114	L.F.			
d.	6" asbestos-cement pipe, Class 150	1,313	L.F.			
e.	8" asbestos-cement pipe, Class 150	91	L.F.			
f.	3/8" O.D. copper tube, Type K	3,885	L.F.			
g.	6" gate valve, with C.I. valve box	1	Only			
h.	Ledge rock exvavation, trench	60	C.Y.			
	SUBTOTAL, SECTION B-1					

SCHEDULE OF BID ITEMS

ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE		
				WRITTEN AMOUNT	FIGURES	AMOUNT
2.	From Tank Site No. 1 to Tank Site No. 2					
a.	8" asbestos-cement pipe, Class 150	338	L.F.			
b.	8" cast iron pipe, Class 150, M-J	416	L.F.			
c.	4" cast iron pipe, Class 150, M-J	16	L.F.			
d.	8" gate valve and C.I. valve box	1	Only			
e.	4" gate valve and C.I. valve box	1	Only			
f.	Rock excavation, trench	224	C.Y.			
g.	Earth backfill hauled & placed	224	C.Y.			
	SUBTOTAL SECTION B-2					
	TOTAL, SECTION B					
	SECTION C					
1.	Alternate No. 1: Pedestal type elevated tank, 50,000 gallon, at Tank Site No. 1	Lump	Sum			
	SUBTOTAL, ALT. 1					
2.	Alternate No. 2: Ground level storage tank, 50,000 gallon, at Tank Site No. 2					
a.	Rock excavation (site leveling)	18	C.Y.			
b.	6" oiled sand cushion, in place	Lump	Sum			

SCHEDULE OF BID ITEMS

ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE		AMOUNT
				WRITTEN AMOUNT	FIGURES	
2. c.	50,000 gallon steel tank, complete in place	Lump	Sum			
	SUBTOTAL, ALT. 2					
	TOTAL, SECTIONS A, B-1 & C-1					
	TOTAL, SECTIONS A, B-1, B-2 & C-2					

BIDDER _____

ADDRESS _____

BY _____

TITLE _____

DATE RECEIVED _____

CHECK SIGNATURE _____

SECTION 1.4
AGREEMENT

1.4.01 THIS AGREEMENT, made as of the _____ day of _____ 19____
by and between The Black Hills Biltmore Corporation,
Rapid City, South Dakota hereinafter called the OWNER,
and _____
_____, hereinafter called the CONTRACTOR

WITNESSETH, That whereas the OWNER intends to _____
_____, hereinafter called the PROJECT, in
accordance with the Drawings, Specifications and other Contract Documents prepared by _____
Staven Engineering Company, Rapid City, South Dakota

NOW, THEREFORE, The OWNER and CONTRACTOR for the considerations hereinafter set forth,
agree as follows:

1.4.02 THE CONTRACTOR AGREES to furnish all the necessary labor, materials, equipment, tools and
services necessary to perform and complete in a workmanlike manner all work required for the construction of
the Project, in strict compliance with the Contract Documents herein mentioned, which are hereby made a
part of the Contract, including the following Addenda:

Addendum No.

Dated

1.4.02 THE CONTRACTOR AGREES (Continued)

a. **Contract Time:** Work under this Agreement shall be commenced upon written notice to proceed, and shall be completed within _____ calendar days of the commencement of the Contract Time as defined in the General Conditions of the Contract.

b. **Sub-Contractors:** The Contractor agrees to bind every sub-contractor by the terms of the Contract Documents. The Contract Documents shall not be construed as creating any contractual relation between any sub-contractor and the Owner.

1.4.03 **THE OWNER AGREES** to pay, and the Contractor agrees to accept, in full payment for the performance of this Contract, the Contract amount of:

_____ Dollars (\$_____) in accordance with the provisions of the Contract Documents.

a. **Progress Payments** will be made in accordance with the General Conditions of the Contract.

1.4.04 **CONTRACT DOCUMENTS:** The Contract comprises the Contract Documents listed in Paragraph 2.1.01 of the General Conditions of the Contract. In the event that any provision of one Contract Document conflicts with the provision of another Contract Document, the provision in that Contract Document first listed below shall govern, except as otherwise specifically stated:

- a. Agreement (This Instrument)
- b. Addenda to Contract Documents
- c. Remaining Legal and Procedural Documents
 1. Proposal
 2. Information for Bidders
 3. Advertisement
- d. Detailed Specification Requirements
- e. Drawings
- f. Modifications of the General Conditions of the Contract (Section 2.8)
- g. General Conditions of the Contract (Sections 2.1 through 2.7)
- h. Bonds
 1. Performance Bond
 2. ~~Labor and Material Payment Bond~~
 3. Proposal Guaranty

1.4.05 **AUTHORITY AND RESPONSIBILITY OF THE ENGINEER:** All work shall be done under the general supervision of the Engineer. The Engineer shall decide any and all questions which may arise as to the quality and acceptability of materials furnished, work performed, rate of progress of work, interpretation of Drawings and Specifications and all questions as to the acceptable fulfillment of the Contract on the part of the Contractor.

1.4.06. **SUCCESSORS AND ASSIGNS:** This Agreement and all of the covenants hereof shall inure to the benefit of and be binding upon the Owner and the Contractor respectively and his partner., successors, assigns and legal representatives. Neither the Owner nor the Contractor shall have the right to assign, transfer or sublet his interests or obligations hereunder without written consent of the other party.

1.4.07 SPECIAL PROVISIONS: The Owner and the Contractor mutually agree that this Agreement shall be subject to the following Special Provisions, which shall supersede other conflicting provisions of this Agreement

Clearing and grubbing of the reservoir basin below Elev. 4460, other than that done for the bed of the dam, will be done by the Owner.

Trees larger than 6" diameter at breast height may be low-cut not more than one foot above ground and the stumps left in place. Small trees and brush to be uprooted or grubbed out by bulldozer or other means.

All timber, brush and slashings shall be removed from the reservoir basin and disposed of by burning, or otherwise. If brush and slashings are burned, this shall be done at such time when sufficient snow cover exists to provide adequate safeguard against the spread of fire. This shall be done at such locations that ashes, charcoal, etc., will not wash back into the reservoir until thoroughly leached out.

1.4.08 IN WITNESS WHEREOF, the parties have made and executed this Agreement, the day and year first above written.

The Black Hills Biltmore Corp.
OWNER

CONTRACTOR

BY

BY

TITLE

TITLE

BUSINESS ADDRESS

BUSINESS ADDRESS

Rapid City, South Dakota
CITY STATE

CITY STATE

SECTION 1.5

BID BOND

1.5.01 KNOW ALL MEN BY THESE PRESENTS, that we _____
_____, hereinafter called the Principal,
as Principal, and the _____
_____, of _____
a corporation duly organized under the laws of the State of _____
hereinafter called the Surety, as Surety, are held and firmly bound unto _____
The Black Hills Biltmore Corporation
_____ hereinafter called the Obligees,
in the sum of _____ Dollars

(\$ _____), for the payment of which sum well and truly to be made, the said Principal and the
said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally,
firmly by these presents.

1.5.02 WHEREAS, the Principal has submitted a bid for _____ construction of a
water supply system

1.5.03 NOW, THEREFORE, if the Obligees shall accept the bid of the Principal and the Principal shall
enter into a Contract with the Obligees in accordance with the terms of such bid, and give such bond or bonds
as may be specified in the bidding or Contract Documents with good and sufficient surety for the faithful per-
formance of such Contract and for the prompt payment of labor and material furnished in the prosecution
thereof or in the event of the failure of the Principal to enter such contract and give such bond or bonds, if
the Principal shall pay to the Obligees the difference not to exceed the penalty hereof between the amount
specified in said bid and such larger amount for which the Obligees may in good faith contract with another
party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain
in full force and effect.

1.5.04 SIGNED AND SEALED this _____ day of _____ A. D. 19____

In the presence of:

WITNESS _____

{ _____ (Seal)
PRINCIPAL

TITLE

WITNESS _____

{ _____ (Seal)
SURETY

TITLE

SECTION 1.6
PERFORMANCE BOND

1.6.01 KNOW ALL MEN BY THESE PRESENTS that _____

(Here insert the name and address or legal title of the Contractor)

as Principal, hereinafter called Contractor, and _____

(Here insert the legal title of Surety)

as Surety, hereinafter called Surety, are held and firmly bound unto _____

The Black Hills Biltmore Corporation, Rapid City, South Dakota

(Here insert the name and address or legal title of the Owner)

as Obligor, hereinafter called Owner, in the amount of

_____ Dollars (\$ _____),

for the payment whereof Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

1.6.02 WHEREAS, Contractor has by written agreement dated _____, 19 _____

entered into a Contract with Owner for construction of a water supply

system

in accordance with drawings and specifications prepared by _____

Staven Engineering Company, Rapid City, South Dakota

(Here insert full name and title)

which Contract is by reference made a part hereof, and is hereinafter referred to as the Contract.

1.6.03 NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if Contractor shall promptly and faithfully perform said Contract, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

a. The Surety hereby waives notice of any alteration or extension of time made by the Owner.

b. Whenever Contractor shall be, and declared by Owner to be in default under the Contract, the Owner having performed Owner's obligations thereunder, the Surety may promptly remedy the default, or shall promptly

1. Complete the Contract in accordance with its terms and conditions, or

2. Obtain a bid or bids for submission to Owner for completing the Contract in accordance with its terms and conditions, and upon determination by Owner and Surety of the lowest responsible bidder, arrange for a contract between such bidder and Owner, and make available as work progresses (even though there should be a default or a succession of defaults under the contract or contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the balance of the Contract price; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the amount set forth in the first paragraph hereof. The term "balance of the Contract price," as used in this paragraph, shall mean the total amount payable by Owner to Contractor under the Contract and any amendments thereto, less the amount properly paid by Owner to Contractor.

c. Any suit under this bond must be instituted before the expiration of two (2) years from the date on which final payment under the Contract falls due.

d. No right of action shall accrue on this bond to or for the use of any person or corporation other than the Owner named herein or the heirs, executors, administrators or successors of Owner.

1.6.04 SIGNED AND SEALED this _____ day of _____ A. D. 19____

In the presence of:

WITNESS

PRINCIPAL (Seal)

TITLE

WITNESS

SURETY (Seal)

TITLE

GENERAL CONDITIONS OF THE CONTRACT

Copyright 1958

CONSULTING ENGINEERS COUNCIL

Springfield, Illinois

SECTION 2.1 DEFINITIONS

2.1.01 CONTRACT DOCUMENTS: The Contract comprises the following documents, including all additions, deletions and modifications incorporated therein before the execution of the Contract:

- a. Legal and Procedural Documents
 - 1. Advertisement
 - 2. Information for Bidders
 - 3. Proposal
 - 4. Proposal Guaranty
 - 5. Contract
 - 6. Performance Bond
- b. General Conditions of the Contract
- c. Detailed Specification Requirements
- d. Drawings

2.1.02 ENGINEER is the Engineer named in the Contract Documents or his representative duly authorized in writing to act for the Engineer.

2.1.03 OWNER is the Owner named in the Contract Documents.

2.1.04 CONTRACTOR is the Contractor named in the Contract Documents.

2.1.05 SUB-CONTRACTOR is any person, firm or corporation with a direct contract with the Contractor who acts for or in behalf of the Contractor in executing any part of the Contract, but does not include one who merely furnishes material.

2.1.06 PROPOSAL: The offer of a Bidder to perform the work described by the Contract Documents when made out and submitted on the prescribed Proposal Form, properly signed and guaranteed.

2.1.07 PROPOSAL GUARANTY: The cashier's check or Bidder's bond accompanying the Proposal submitted by the Bidder, as a guaranty that the Bidder will enter into a Contract with the Owner for the construction of the work, if the Contract is awarded to him.

2.1.08 CONTRACT is the agreement covering the performance of the work described in the Contract Documents including all supplemental agreements thereto and all general and special provisions pertaining to the work or materials therefor.

2.1.09 PERFORMANCE BOND is the approved form of security furnished by the Contractor and his Surety as a guaranty of good faith on the part of the Contractor to execute the work in accordance with the terms of the Contract.

2.1.10 SURETY is the person, firm or corporation who executes the Contractor's Performance Bond.

2.1.11 SPECIFICATIONS shall mean the Legal and Procedural Documents, General Conditions of the Contract, together with the modifications thereof, and the Detailed Specification Requirements, with all addenda thereto.

2.1.12 DRAWINGS are those listed in the Index to Specifications and Drawings with all addenda thereto.

2.1.13 WRITTEN NOTICE: Written notice shall be considered as served when delivered in person or sent by registered mail to the individual, firm or corporation or to the last business address of such known to him who serves the notice.

a. **Change of Address:** It shall be the duty of each party to advise the other parties to the Contract as to any change in his business address until completion of the Contract.

2.1.14 ACT OF GOD means an earthquake, flood, cyclone or other cataclysmic phenomenon of nature. Rain, wind, flood or other natural phenomenon of normal intensity for the locality shall not be construed as an Act of God and no reparation shall be made to the Contractor for damages to the work resulting therefrom.

SECTION 2.2 DRAWINGS, SPECIFICATIONS AND RELATED DATA

2.2.01 INTENT OF DRAWINGS AND SPECIFICATIONS: The intent of the Drawings and Specifications is that the Contractor furnish all labor and materials, equipment and transportation necessary for the proper execution of the work unless specifically noted otherwise. The Contractor shall do all the work shown on the Drawings and described in the Specifications and all incidental work considered necessary to complete the project in a substantial and acceptable manner, and to fully complete the work or improvement, ready for use, occupancy and operation by the Owner.

2.2.02 CONFLICT: If there be conflicting variance between the Drawings and the Specifications, the provisions of the Specifications shall control. In case of conflict between the General Conditions of the Contract or any modifications thereof and the Detailed Specification Requirements, the Detailed Specification Requirements shall control.

2.2.03 DISCREPANCIES IN DRAWINGS: Any discrepancies found between the Drawings and Specifications and site conditions or any errors or omissions in the Drawings or Specifications shall be immediately reported to the Engineer, who shall promptly correct such error or omission in writing. Any work done by the Contractor after his discovery of such discrepancies, errors or omissions shall be done at the Contractor's risk.

2.2.04 ADEQUACY OF DRAWINGS AND SPECIFICATIONS: Responsibility for adequacy of the design and for sufficiency of the Drawings and Specifications shall be borne by the Owner. The complete requirements of the work to be performed under the Contract shall be set forth in Drawings and Specifications to be supplied by the Owner through the Engineer or by the Engineer as representative of the Owner. Drawings and Specifications furnished shall be in accordance with the Contract Documents and shall be true and accurate developments thereof.

2.2.05 ADDITIONAL INSTRUCTIONS: Further instructions may be issued by the Engineer during the progress of the work by means of Drawings or otherwise to make more clear or specific the Drawings and Specifications or as may be necessary to explain or illustrate changes in the work to be done.

2.2.06 COPIES OF DRAWINGS AND SPECIFICATIONS FURNISHED: Except as provided for otherwise, all required copies of Drawings and Specifications necessary for the execution of the work shall be furnished to the Contractor without charge.

2.2.07 DRAWINGS AND SPECIFICATIONS AT JOB SITE: One complete set of all Drawings and Specifications shall be maintained at the job site and shall be available to the Engineer at all times.

2.2.08 OWNERSHIP OF DRAWINGS AND SPECIFICATIONS: All original or duplicated Drawings and Specifications and other data prepared by the Engineer shall remain the property of the Engineer, and they shall not be re-used on other work, but shall be returned to him upon completion of the work.

2.2.09 DIMENSIONS: Figured dimensions on the plans will be used in preference to scaling the Drawings. Where the work of the Contractor is affected by finish dimensions, these shall be determined by the Contractor at the site, and he shall assume the responsibility therefor.

2.2.10 MODELS: All models prepared for this work shall become the property of the Owner at the completion of the work.

2.2.11 SAMPLES: All samples called for in the Specifications or required by the Engineer shall be furnished by the Contractor and shall be submitted to the Engineer for his approval. Samples shall be furnished so as not to delay fabrication, allowing the Engineer reasonable time for the consideration of the samples submitted.

a. **Samples for Tests:** Contractor shall furnish such samples of material as may be required for examination and test. All materials and workmanship shall be in accordance with approved samples. All samples of materials for tests shall be taken according to methods provided in the Specifications.

2.2.12 SHOP DRAWINGS: The Contractor shall provide shop drawings, settings, schedules and such other drawings as may be necessary for the prosecution of the work in the shop and in the field as required by the Drawings, Specifications or Engineer's instructions. Deviations from the Drawings and Specifications shall be called to the attention of the Engineer at the time of the first submission of shop drawings and other drawings for approval. The Engineer's approval of any drawings shall not release the Contractor from responsibility for such deviations. Shop drawings shall be submitted according to the following schedule:

a. Three copies shall be submitted at least thirty (30) days before the materials indicated thereon are to be needed, or earlier if required to prevent delay of the work.

b. The Engineer shall, within fourteen (14) days of the submittal of any shop drawings, return one copy to the Contractor marked with all corrections and changes.

c. The Contractor shall then correct the shop drawings to conform to the corrections and changes requested by the Engineer.

d. Following completion of such corrections and changes, the Contractor shall furnish the Engineer two copies of the shop drawings conforming to the required corrections and changes.

2.2.13 QUALITY OF EQUIPMENT AND MATERIALS: In order to establish standards of quality, the Engineer has, in the detailed Specifications, referred to certain products by name and catalog number. This procedure is not to be construed as eliminating from competition other products of equal or better quality by other manufacturers where fully suitable in design.

a. The Contractor shall furnish the complete list of proposed desired substitutions prior to signing of the Contract, together with such engineering and catalog data as the Engineer may require.

b. The Contractor shall abide by the Engineer's judgment when proposed substitute materials or items of equipment are judged to be unacceptable and shall furnish the specified material or item of equipment in such case. All proposals for substitutions shall be submitted in writing by the General Contractor and not by individual trades or material suppliers. The Engineer will approve or disapprove proposed substitutions in writing within a reasonable time. No substitute materials shall be used unless approved in writing.

2.2.14 EQUIPMENT APPROVAL DATA: The Contractor shall furnish one copy of complete catalog data for every manufactured item of equipment and all components to be used in the work, including specific performance data, material description, rating, capacity, working pressure, material gage or thickness, brand name, catalog number and general type.

a. This submission shall be compiled by the Contractor and approved by the Engineer before any of the equipment is ordered.

b. Each data sheet or catalog in the submission shall be indexed according to specification section and paragraph for easy reference.

c. After written approval, this submission shall become a part of the Contract, and may not be deviated from except upon written approval of the Engineer.

d. Catalog data for equipment approved by the Engineer does not in any case supersede the Engineer's Contract Documents. The approval of the Engineer shall not relieve the Contractor from responsibility for deviations from Drawings or Specifications, unless he has in writing called the Engineer's attention to such deviations at the time of submission, nor shall it relieve him from responsibility for errors of any sort in the items submitted. The Contractor shall check the work described by the catalog data with the Engineer's Contract Documents for deviations and errors.

e. It shall be the responsibility of the Contractor to insure that items to be furnished fit the space available. He shall make necessary field measurements to ascertain space requirements, including those for connections, and shall order such sizes and shapes of equipment that the final installation shall suit the true intent and meaning of the Drawings and Specifications.

f. Where equipment requiring different arrangement of connections from those shown is approved, it shall be the responsibility of the Contractor to install the equipment to operate properly, and in harmony with the intent of the Drawings and Specifications, and to make all changes in the work required by the different arrangement of connections.

2.2.15 SURVEYS: Unless otherwise specified, the Owner shall establish all base lines for the location of the principal component parts of the work together with a suitable number of bench marks adjacent to the work. Based upon the information provided by the Owner, the Contractor shall develop and make all detail surveys necessary for construction, including slope stakes, batter boards, stakes for pile locations and other working points, lines and elevations. The Contractor shall have the responsibility to carefully preserve bench marks, reference points and stakes, and, in the case of destruction thereof by the Contractor or resulting from his negligence, the Contractor shall be charged with the expense and damage resulting therefrom and shall be responsible for any mistakes that may be caused by the unnecessary loss or disturbance of such bench marks, reference points and stakes.

SECTION 2.3 ENGINEER-OWNER-CONTRACTOR RELATIONS

2.3.01 ENGINEER'S RESPONSIBILITY AND AUTHORITY: All work shall be done under the general supervision of the Engineer. The Engineer shall decide any and all questions which may arise as to the quality and acceptability of materials furnished, work performed, rate of progress of work, interpretation of Drawings and Specifications and all questions as to the acceptable fulfillment of the Contract on the part of the Contractor.

2.3.02 ENGINEER'S DECISIONS: All claims of the Owner or the Contractor shall be presented to the Engineer for decision which shall be made in writing within a reasonable time. All decisions of the Engineer shall be final except in cases where time and/or financial considerations are involved, which shall be subject to arbitration.

2.3.03 SUSPENSION OF WORK: The Engineer shall have the authority to suspend the work, wholly or in part, for such period or periods, as he may deem necessary, due to unsuitable weather, or such other conditions as are considered unfavorable for prosecution of the work, or failure on the part of the Contractor to carry out the provisions of the Contract or to supply materials meeting the requirements of the Specifications. The Contractor shall not suspend operation without the Engineer's permission.

2.3.04 ARBITRATION: Should there be any dispute or any questioned decision of the Engineer which is subject to arbitration, it shall be promptly submitted to arbitration upon demand by either party to the dispute. The Contractor shall not delay the work because arbitration proceedings are pending unless he shall have written permission from the Engineer so to do and such delay shall not extend beyond the time when the arbitrators shall have opportunity to determine whether the work shall continue or be suspended pending decision by the arbitrators of such a dispute. Any demand for arbitration shall be in writing and shall be delivered to the Engineer and any adverse party either by personal delivery or by registered mail addressed to the last known address of each within ten (10) days of receipt of the Engineer's decision, and in no event after final payment has been made and accepted, subject, however, to any express stipulation to the contrary in the Contract Documents. Should the Engineer fail within a reasonable period to make a decision, a demand for arbitration may then be made as if the Engineer's decision had been rendered against the party demanding arbitration.

a. No one shall be qualified to act as an arbitrator who has, directly or indirectly, any financial interest in the Contract or who has any business or family relationship with the Owner, the Contractor, or the Engineer. Each arbitrator selected shall be qualified by experience and knowledge of the work involved in the matter to be submitted to arbitration.

b. Arbitration shall be in accordance with the procedure and standards of The American Arbitration Association.

2.3.05 INSPECTION OF WORK: All materials and each part or detail of the work shall be subject at all times to inspection by the Engineer, and the Contractor will be held strictly to the true intent of the Specifications in regard to quality of materials, workmanship, and the diligent execution of the Contract. Such inspection may include mill, plant, or shop inspection, and any material furnished under these Specifications is subject to such inspection. The Engineer shall be allowed access to all parts of the work and shall be furnished with such information and assistance by the Contractor as is required to make a complete and detailed inspection.

2.3.06 EXAMINATION OF COMPLETED WORK: If the Engineer requests it, the Contractor at any time before acceptance of the work shall remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore said portions of the work to the standard required by the Specifications. Should the work thus exposed or examined prove acceptable, the uncovering or removing, and the replacing of the covering or making good of the parts removed shall be paid for as Extra Work, but should the work so exposed or examined prove unacceptable, the uncovering, removing and replacing shall be at the Contractor's expense.

2.3.07 CONTRACTOR'S SUPERINTENDENCE: A qualified superintendent, who is acceptable to the Engineer, shall be maintained on the work and give efficient supervision to the work until its completion. The superintendent shall have full authority to act in behalf of the Contractor, and all directions given to the superintendent shall be considered given to the Contractor. In general, the Engineer's instructions shall be confirmed in writing and always upon written request from the Contractor.

2.3.08 LANDS BY OWNER: The Owner shall provide the lands shown on the Drawings upon which the work under the Contract is to be performed and to be used for rights of way for access. Any delay in furnishing these lands by the Owner shall be deemed proper cause for adjustment in the Contract Amount and in the time of completion.

2.3.09 LANDS BY CONTRACTOR: Any additional land and access thereto not shown on the Drawings that may be required for temporary construction facilities or for storage of materials shall be provided by the Contractor with no liability to the Owner. The Contractor shall confine his apparatus and storage of materials and operation of his workmen to those areas described in the Drawings and Specifications and such additional areas which he may provide as approved by the Engineer.

2.3.10 PRIVATE PROPERTY: The Contractor shall not enter upon private property for any purpose without obtaining permission, and he shall be responsible for the preservation of all public property, trees, monuments, etc. along and adjacent to the street and/or right-of-way, and shall use every precaution necessary to prevent damage or injury thereto. He shall use suitable precautions to prevent damage to pipes, conduits, and other underground structures, and shall protect carefully from disturbance or damage all monuments and property marks until an authorized agent has witnessed or otherwise referenced their location and shall not remove them until directed.

2.3.11 ASSIGNMENT OF CONTRACT: Neither the Contractor nor the Owner shall sublet, sell, transfer, assign or otherwise dispose of the Contract or any portion thereof, or of his right, title or interest therein, or his obligations thereunder, without written consent of the other party.

2.3.12 REMOVAL OF CONSTRUCTION EQUIPMENT, TOOLS AND SUPPLIES: At the termination of this Contract, before acceptance of the work by the Engineer, the Contractor shall remove all of his equipment, tools and supplies from the property of the Owner. Should the Contractor fail to remove such equipment, tools, and supplies, the Owner shall have the right to remove them.

2.3.13 SUSPENSION OF WORK BY OWNER: The work or any portion thereof may be suspended at any time by the Owner provided that he gives the Contractor five (5) days' written notice of suspension, which shall set forth the date on which work is to be resumed. The Contractor shall resume the work upon written notice from the Owner and within ten (10) days after the date set forth in the notice of suspension. If the Owner does not give written notice to resume work within ten (10) days of the date fixed in the notice of suspension, the Contractor may abandon that portion of the work so suspended and shall be entitled to payment in accordance with Paragraph 2.7.11.

2.3.14 OWNER'S RIGHT TO CORRECT DEFICIENCIES: Upon failure of the Contractor to perform the work in accordance with the Contract Documents, including any requirements with respect to the Schedule of Completion, and after five (5) days' written notice to the Contractor and receipt of written approval from the Engineer, the Owner may, without prejudice to any other remedy he may have, correct such deficiencies.

2.3.15 OWNER'S RIGHT TO TERMINATE CONTRACT AND COMPLETE THE WORK: The Owner shall have the right to terminate the employment of the Contractor after giving ten (10) days' written notice of termination to the Contractor in the event of any default by the Contractor and upon receiving written notice from the Engineer certifying cause for such action. In the event of such termination, the Owner may take possession of the work and of all materials, tools and equipment thereon and may finish the work by whatever method and means he may select. It shall be considered a default by the Contractor whenever he shall:

- a. Declare bankruptcy, become insolvent, or assign his assets for the benefit of his creditors.
- b. Disregard or violate important provisions of the Contract Documents or Engineer's instructions, or fail to prosecute the work according to the agreed Schedule of Completion, including extensions thereof.
- c. Fail to provide a qualified superintendent, competent workmen or sub-contractors, or proper materials, or fail to make prompt payment therefor.

2.3.16 CONTRACTOR'S RIGHT TO SUSPEND WORK OR TERMINATE CONTRACT: The Contractor may suspend work or terminate Contract upon ten (10) days' written notice to the Owner and the Engineer, for any of the following reasons:

- a. If an order of any court, or other public authority caused the work to be stopped or suspended for a period of ninety (90) days through no act or fault of the Contractor or his employees.
- b. If the Engineer should fail to act upon any Request for Payment within ten (10) days after it is presented in accordance with the General Conditions of the Contract.
- c. If the Owner should fail to act upon any Request for Payment within thirty (30) days after its approval by the Engineer.
- d. If the Owner should fail to pay the Contractor any sum within thirty (30) days after its award by arbitrators.

2.3.17 RIGHTS OF VARIOUS INTERESTS: Wherever work being done by the Owner's forces or by other contractors is contiguous to work covered by this Contract, the respective rights of the various interests involved shall be established by the Engineer, to secure the completion of the various portions of the work in general harmony.

2.3.18 SEPARATE CONTRACTS: The Owner may let other contracts in connection with the work of the Contractor. The Contractor shall cooperate with other Contractors with regard to storage of materials and execution of their work. It shall be the Contractor's responsibility to inspect all work by other Contractors affecting his work and to report to the Engineer any irregularities which will not permit him to complete his work in a satisfactory manner. His failure to notify the Engineer of such irregularities shall indicate the work of other Contractors has been satisfactorily completed to receive his work. The Contractor shall not be responsible for defects of which he could not have known, which develop in the work of others after the work is completed. It shall be the responsibility of the Contractor to measure the completed work in place and report to the Engineer immediately any difference between completed work by others and the Drawings.

2.3.19 SUB-CONTRACTS: At the time specified by the Contract Documents or when requested by the Engineer, the Contractor shall submit in writing to the Owner for approval of the Engineer the names of the sub-contractors proposed for the work. Sub-contractors may not be changed except at the request or with the approval of the Engineer. The Contractor is responsible to the Owner for the acts and omissions of his sub-contractors, and of their direct and indirect employees, to the same extent as he is responsible for the acts and omissions of his employees. The Contract Documents shall not be construed as creating any contractual relation between any sub-contractor and the Owner. The Contractor shall bind every sub-contractor by the terms of the Contract Documents.

a. For convenience of reference and to facilitate the letting of Contracts and sub-contracts, the Specifications are separated into titled sections. Such separations shall not, however, operate to make the Engineer an arbiter to establish limits to the contracts between Contractor and sub-contractors.

2.3.20 WORK DURING AN EMERGENCY: The Contractor shall perform any work and shall furnish and install any materials and equipment necessary during an emergency endangering life or property. In all cases he shall notify the Engineer of the emergency as soon as practicable, but he shall not wait for instructions before proceeding to properly protect both life and property.

2.3.21 ORAL AGREEMENTS: No oral order, objection, claim or notice by any party to the others shall affect or modify any of the terms or obligations contained in any of the Contract Documents, and none of the provisions of the Contract Documents shall be held to be waived or modified by reason of any act whatsoever, other than by a definitely agreed waiver or modification thereof in writing, and no evidence shall be introduced in any proceeding of any other waiver or modification.

SECTION 2.4 MATERIALS AND WORKMANSHIP

2.4.01 MATERIALS FURNISHED BY THE CONTRACTOR: All materials used in the work shall meet the requirements of the respective Specifications, and no material shall be used until it has been approved by the Engineer. All materials not otherwise specifically indicated shall be furnished by the Contractor.

2.4.02 MATERIALS FURNISHED BY THE OWNER: Materials specifically indicated shall be furnished by the Owner. The fact that the Owner is to furnish material is conclusive evidence of its acceptability for the purpose intended, and the Contractor may continue to use it until otherwise directed. If the Contractor discovers any defect in material furnished by the Owner, he shall notify the Engineer. Unless otherwise noted or specifically stated, materials furnished by the Owner, which are not of local occurrence, are considered to be f.o.b. the nearest railroad station. The Contractor shall be prepared to unload and properly protect all such material from damage or loss. The Contractor shall be responsible for material loss or damage after receipt of material at the point of delivery.

2.4.03 STORAGE OF MATERIALS: Materials shall be so stored as to insure the preservation of their quality and fitness for the work. When considered necessary, they shall be placed on wooden platforms or other hard, clean surfaces, and not on the ground, and/or they shall be placed under cover. Stored materials shall be located so as to facilitate prompt inspection. Private property shall not be used for storage purposes without the written permission of the owner or lessee.

2.4.04 CHARACTER OF WORKMEN: The Contractor shall at all times be responsible for the conduct and discipline of his employees and/or any sub-contractor or persons employed by sub-contractors. All workmen must have sufficient knowledge, skill, and experience to perform properly the work assigned to them. Any foreman or workman employed by the Contractor or sub-contractor who, in the opinion of the Engineer, does not perform his work in a skillful manner, or appears to be incompetent or to act in a disorderly or intemperate manner shall, at the written request of the Engineer, be discharged immediately and shall not be employed again in any portion of the work without the approval of the Engineer.

2.4.05 REJECTED WORK AND MATERIALS: All materials which do not conform to the requirements of the Contract Documents, are not equal to samples approved by the Engineer, or are in any way unsatisfactory or unsuited to the purpose for which they are intended, shall be rejected. Any defective work whether the result of poor workmanship, use of defective materials, damage through carelessness or any other cause shall be removed within ten (10) days after written notice is given by the Engineer, and the work shall be re-executed by the Contractor. The fact that the Engineer may have previously overlooked such defective work shall not constitute an acceptance of any part of it.

a. Should the Contractor fail to remove rejected work or materials within ten (10) days after written notice to do so, the Owner may remove them and may store the materials.

b. Correction of Faulty Work After Final Payment shall be in accordance with Paragraph 2.7.19.

2.4.06 MANUFACTURER'S DIRECTIONS: Manufactured articles, material and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturer unless herein specified to the contrary.

2.4.07 CUTTING AND PATCHING: The Contractor shall do all necessary cutting and patching of the work that may be required to properly receive the work of the various trades or as required by the Drawings and Specifications to complete the structure. He shall restore all such cut or patched work as directed by the Engineer. Cutting of existing structure that shall endanger the work, adjacent property, workmen or the public shall not be done unless approved by the Engineer and under his direction.

2.4.08 CLEANING UP: The Contractor shall remove from the Owner's property, and from all public and private property, all temporary structures, rubbish, and waste materials resulting from his operation or caused by his employees, and shall remove all surplus materials leaving the site smooth, clean and true to line and grade.

2.4.09 GUARANTY PERIOD: The Contractor shall warrant all equipment furnished and work performed by him for a period of one year from the date of written acceptance of the work.

a. Correction of Faulty Work After Final Payment shall be as provided in Paragraph 2.7.19.

SECTION 2.5 INSURANCE, LEGAL RESPONSIBILITY AND PUBLIC SAFETY

2.5.01 INSURANCE: The Contractor shall secure and maintain such insurance from an insurance company authorized to write casualty insurance in the State where the work is located as will protect himself, his sub-contractors, and the Owner from claims for bodily injury, death or property damage which may arise from operations under this Contract. The Contractor shall not commence work under this Contract until he has obtained all insurance required under this paragraph and shall have filed the certificate of insurance or the certified copy of the insurance policy with the Owner. Each insurance policy shall contain a clause providing that it shall not be cancelled by the insurance company without ten (10) days' written notice to the Owner of intention to cancel. The amounts of such insurance shall be not less than the following:

a. Workmen's Compensation and Employer's Liability Insurance shall be secured and maintained as required by the State where the work is located.

b. Public Liability, Bodily Injury, and Property Damage:

1. Injury or death of one person:\$ 50,000
2. Injury to more than one person in a single accident.\$200,000
3. Property Damage:\$ 50,000

c. Automobile and Truck Public Liability, Bodily Injury, and Property Damage:

1. Injury or death of one person:\$ 50,000
2. Injury to more than one person in a single accident:\$200,000
3. Property Damage:\$ 50,000

2.5.02 INDEMNITY: The Contractor shall indemnify and save harmless the Owner from and against all losses and all claims, demands, payments, suits, actions, recoveries and judgments of every nature and description brought or recovered against him by reason of any omission or act of the Contractor his agents or employees, in the execution of the work or in the guarding of it. The Contractor shall obtain in the name of the Owner and shall maintain and pay the premiums for such insurance in such amount and with such provisions as will protect the Owner from contingent liability under this Contract and a copy of such insurance policy or policies shall be delivered to the Owner. Full compliance by the Owner with the terms and provisions of such insurance policy or policies shall be a condition precedent to the Owner's right to enforce against the Contractor any provisions of this article.

2.5.03 FIRE INSURANCE: In addition to such Fire Insurance as the Contractor elects to carry for his own protection, he shall secure and maintain in the name of the Owner policies upon such structures and material and in such amounts as shall be designated in SECTION 2.8 -MODIFICATIONS OF THE GENERAL CONDITIONS. The policies shall be secured from a company which is satisfactory to the Owner and delivered to the Owner.

2.5.04 PERFORMANCE BOND: The Contractor shall, at the time of his execution of the Contract, furnish a corporate surety bond in the sum equal to the Contract Amount. The form of the bond shall be as the Owner may prescribe and with a Surety Company authorized to do business in the State where the work is located.

2.5.05 PATENTS AND ROYALTIES: If any design, device, material or process covered by letters patent or copyright is used by the Contractor, he shall provide for such use by legal agreement with the owner of the patent or a duly authorized licensee of such owner, and shall save harmless the Owner from any and all loss or expense on account thereof, including its use by the Owner.

2.5.06 PERMITS: All permits and licenses necessary for the prosecution of the work shall be secured by the Contractor.

2.5.07 LAWS TO BE OBSERVED: The Contractor shall give all notices and comply with all Federal, State and local laws, ordinances and regulations in any manner affecting the conduct of the work, and all such orders and decrees as exist, or may be enacted by bodies or tribunals having any jurisdiction or authority over the work, and shall indemnify and save harmless the Owner against any claim or liability arising from, or based on, the violation of any such law, ordinance, regulation, order or decree, whether by himself or his employees.

2.5.08 WARNING SIGNS AND BARRICADES: The Contractor shall provide adequate signs, barricades, red lights and watchmen and take all necessary precautions for the protection of the work and the safety of the public. All barricades and obstructions shall be protected at night by red signal lights which shall be kept burning from sunset to sunrise. Barricades shall be of substantial construction and shall be painted white or whitewashed to increase their visibility at night. Suitable warning signs shall be so placed and illuminated at night as to show in advance where construction, barricades, or detours exist.

2.5.09 PUBLIC SAFETY AND CONVENIENCE: The Contractor shall at all times so conduct his work as to insure the least possible obstruction to traffic and inconvenience to the general public and the residents in the vicinity of the work, and to insure the protection of persons and property in a manner satisfactory to the Engineer. No road or street shall be closed to the public except with the permission of the Engineer and proper governmental authority. Fire hydrants on or adjacent to the work shall be kept accessible to fire-fighting equipment at all times. Temporary provisions shall be made by the Contractor to insure the use of sidewalks and the proper functioning of all gutters, sewer inlets, drainage ditches, and irrigation ditches, which shall not be obstructed except as approved by the Engineer.

2.5.10 CROSSING UTILITIES: When new construction crosses highways, railroads, streets or utilities under the jurisdiction of State, County, City or other public agency, public utility or private entity, the Contractor shall secure written permission from the proper authority before executing such new construction. A copy of this written permission must be filed with the Owner before any work is done. The Contractor will be required to furnish a release from the proper authority before final acceptance of the work.

2.5.11 SANITARY PROVISIONS: The Contractor shall provide and maintain such sanitary accommodations for the use of his employees and those of his sub-contractors as may be necessary to comply with the requirements and regulations of the local and State departments of health and as directed by the Engineer.

SECTION 2.6 PROGRESS AND COMPLETION OF WORK

2.6.01 NOTICE TO PROCEED: Following the execution of the Contract by the Owner, written Notice to Proceed with the work shall be given to the Contractor. The Contractor shall begin and shall prosecute the work regularly and uninterruptedly thereafter (unless otherwise directed in writing by the Owner) with such force as to secure the completion of the work within the time stated in the Proposal.

2.6.02 CONTRACT TIME: The Contractor shall complete, in an acceptable manner, all of the work contracted for in the time stated in the Proposal. Computation of Contract Time shall commence on the seventh (7th) day following the date of mailing, by regular mail, of the Notice to Proceed and every calendar day following, except as herein provided, shall be counted as a working day.

2.6.03 SCHEDULE OF COMPLETION: The Contractor shall submit, at such times as may reasonably be requested by the Engineer, schedules which shall show the order in which the Contractor proposes to carry on the work, with dates at which the Contractor will start the several parts of the work, and estimated dates of completion of the several parts.

2.6.04 CHANGES IN THE WORK: The Owner may, as the need arises, order changes in the work through additions, deletions or modifications without invalidating the Contract. Compensation and time of completion affected by the change shall be adjusted at the time of ordering such change.

2.6.05 EXTRA WORK: New and unforeseen items of work found to be necessary and which cannot be covered by any item or combination of items for which there is a Contract price shall be classed as Extra Work. The Contractor shall do such Extra Work and furnish such materials as may be required for the proper completion or construction of the whole work contemplated upon written order from the Owner as approved by the Engineer. In the absence of such written order, no claim for Extra Work shall be considered. Extra Work shall be performed in accordance with these Specifications where applicable and work not covered by the Specifications or special provisions shall be done in accordance with the best practice as approved by the Engineer. Extra Work required in an emergency to protect life and property shall be performed by the Contractor as required.

2.6.06 EXTENSION OF CONTRACT TIME: A delay beyond the Contractor's control occasioned by an Act of God, or act or omission on the part of the Owner or by strikes, lock-outs, fire, etc., may entitle the Contractor to an extension of time in which to complete the work as determined by the Engineer, provided, however, that the Contractor shall immediately give written notice to the Engineer of the cause of such delay.

2.6.07 USE OF COMPLETED PORTIONS: The Owner shall have the right to take possession of and use any completed or partially completed portions of the work, notwithstanding that the time for completing the entire work or such portions may not have expired; but such taking possession and use shall not be deemed an acceptance of any work not completed in accordance with the Contract Documents. If such prior use increases the cost of or delays the completion of uncompleted work or causes refinishing of completed work, the Contractor shall be entitled to such extra compensation, or extension of time or both, as the Engineer may determine.

SECTION 2.7 MEASUREMENT AND PAYMENT

2.7.01 DETAILED BREAKDOWN OF CONTRACT AMOUNT: Except in cases where unit prices form the basis for payment under the Contract, the Contractor shall within ten (10) days of receipt of Notice to Proceed, submit a complete breakdown of the Contract Amount showing the value assigned to each part of the work, including an allowance for profit and overhead. Upon approval of the breakdown of the Contract Amount by the Engineer, it shall be used as the basis for all Requests for Payment.

2.7.02 REQUESTS FOR PAYMENT: The Contractor may submit periodically but not more than once each month a Request for Payment for work done and materials delivered and stored on the site. The Contractor shall furnish the Engineer all reasonable facilities required for obtaining the necessary information relative to the progress and execution of the work. Payment for materials stored on the site will be conditioned upon evidence submitted to establish the Owner's title to such materials. Each Request for Payment shall be computed from the work completed on all items listed in the Detailed Breakdown of Contract Amount, less 10% to be retained until final completion and acceptance of the work, and less previous payments. Where unit prices are specified, the Request for Payment shall be based on the quantities completed.

2.7.03 ENGINEER'S ACTION ON A REQUEST FOR PAYMENT: Within ten (10) days of submission of any Request for Payment by the Contractor, the Engineer shall:

- a. Approve the Request for Payment as submitted.
- b. Approve such other amount as he shall decide is due the Contractor, informing the Contractor in writing of his reasons for approving the amended amount.
- c. Withhold the Request for Payment, informing the Contractor in writing of his reasons for withholding it.

2.7.04 OWNER'S ACTION ON AN APPROVED REQUEST FOR PAYMENT: Within thirty (30) days from the date of approval of a Request for Payment by the Engineer, the Owner shall:

- a. Pay the Request for Payment as approved.
- b. Pay such other amount in accordance with Paragraph 2.7.05 as he shall decide is due the Contractor, informing the Contractor and the Engineer in writing of his reasons for paying the amended amount.
- c. Withhold payment in accordance with Paragraph 2.7.05 informing the Contractor and the Engineer of his reasons for withholding payment.

2.7.05 OWNER'S RIGHT TO WITHHOLD PAYMENT OF AN APPROVED REQUEST FOR PAYMENT: The Owner may withhold payment in whole or in part on an approved Request for Payment to the extent necessary to protect himself from loss on account of any of the following causes discovered subsequent to approval of a Request for Payment by the Engineer:

- a. Defective work.
- b. Evidence indicating the probable filing of claims by other parties against the Contractor.
- c. Failure of the Contractor to make payments to sub-contractors, material suppliers or labor.
- d. Damage to another contractor.

2.7.06 INTEREST ON UNPAID REQUESTS FOR PAYMENT: Should the Owner fail to pay an approved Request for Payment within thirty (30) days from the date of approval by the Engineer, and should he fail to inform the Engineer and the Contractor in writing of his reasons for withholding payment, the Owner shall pay the Contractor interest on the amount of the Request for Payment at the rate of six per cent (6%) per annum until payment is made.

2.7.07 RESPONSIBILITY OF THE CONTRACTOR: Unless specifically noted otherwise, the Contractor shall furnish all materials and services and perform all the work described by the Contract Documents or shall have all materials and services furnished and all the work performed at his expense. It shall be the Contractor's responsibility to pay for:

- a. Replacement of survey bench marks, reference points and stakes provided by the Owner under Paragraph 2.2.15.
- b. Lands by Contractor provided in accordance with Paragraph 2.3.09.
- c. Insurance obtained in accordance with Paragraphs 2.5.01 and 2.5.02.
- d. Fire Insurance obtained in accordance with Paragraph 2.5.03.
- e. Performance Bond obtained in accordance with Paragraph 2.5.04.
- f. Royalties required under Paragraph 2.5.05.
- g. Permits and Licenses required of the Contractor and all sub-contractors.

2.7.08 PAYMENT FOR UNCORRECTED WORK: Should the Engineer direct the Contractor not to correct work that has been damaged or that was not performed in accordance with the Contract Documents, an equitable deduction from the Contract Amount shall be made to compensate the Owner for the uncorrected work.

2.7.09 PAYMENT FOR REJECTED WORK AND MATERIALS: The removal of work and materials rejected under Paragraph 2.4.05 and the re-execution of acceptable work by the Contractor shall be at the expense of the Contractor, and he shall pay the cost of replacing the work of other contractors destroyed or damaged by the removal of the rejected work or materials and the subsequent replacement of acceptable work.

a. Removal of rejected work or materials and storage of materials by the Owner in accordance with Paragraph 2.4.05 shall be paid by the Contractor within thirty (30) days after written notice to pay is given by the Owner. If the Contractor does not pay the expenses of such removal and after ten (10) days' written notice being given by the Owner of his intent to sell the materials, the Owner may sell the materials at auction or at private sale and shall pay to the Contractor the net proceeds therefrom after deducting all the costs and expenses that should have been borne by the Contractor.

2.7.10 PAYMENTS FOR EXTRA WORK: Written notice of claims for payments for Extra Work shall be given by the Contractor within ten (10) days after receipt of instructions from the Owner as approved by the Engineer to proceed with the Extra Work and also before any work is commenced, except in emergency endangering life or property. No claim shall be valid unless so made. In all cases, the Contractor's itemized estimate sheets showing all labor and material shall be submitted to the Engineer. The Owner's order for Extra Work shall specify any extension of the Contract Time and one of the following methods of payment:

- a. Unit prices or combinations of unit prices which formed the basis of the original Contract.
- b. A lump sum based on the Contractor's estimate, accepted by the Owner, and approved by the Engineer.
- c. Actual cost plus 15% for overhead and profit.

2.7.11 PAYMENT FOR WORK SUSPENDED BY THE OWNER: If the work or any part thereof shall be suspended by the Owner and abandoned by the Contractor as provided in Paragraph 2.3.13, the Contractor will then be entitled to payment for all work done on the portions so abandoned, plus 15% of the value of the abandoned work to compensate for overhead, plant expense, and anticipated profit.

2.7.12 PAYMENT FOR WORK BY THE OWNER: The cost of the work performed by the Owner in removing construction equipment, tools and supplies in accordance with Paragraph 2.3.12 and in correcting deficiencies in accordance with Paragraph 2.3.14 shall be paid by the Contractor.

2.7.13 PAYMENT FOR WORK BY THE OWNER FOLLOWING HIS TERMINATION OF THE CONTRACT: Upon termination of the Contract by the Owner in accordance with Paragraph 2.3.15, no further payments shall be due the Contractor until the work is completed. If the unpaid balance of the Contract Amount shall exceed the cost of completing the work including all overhead costs, the excess shall be paid to the Contractor. If the cost of completing the work shall exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The cost incurred by the Owner, as herein provided, and the damage incurred through the Contractor's default, shall be certified by the Owner, and approved by the Engineer.

2.7.14 PAYMENT FOR WORK TERMINATED BY THE CONTRACTOR: Upon suspension of the work or termination of the Contract by the Contractor in accordance with Paragraph 2.3.16, the Contractor shall recover payment from the Owner for the work performed, plus loss on plant and materials, plus established profit and damages, as approved by the Engineer.

2.7.15 PAYMENT FOR SAMPLES AND TESTING OF MATERIALS: Samples furnished in accordance with Paragraph 2.2.11 shall be furnished by the Contractor at his expense.

a. Testing of samples and materials furnished in accordance with Paragraph 2.2.11 shall be arranged and paid for by the Owner.

2.7.16 RELEASE OF LIENS: The Contractor shall deliver to the Owner a complete release of all liens arising out of this Contract before the retained percentage or before the final Request for Payment is paid. If any lien remains unsatisfied after all payments are made, the Contractor shall refund to the Owner such amounts as the Owner may have been compelled to pay in discharging such liens including all costs and a reasonable attorney's fee.

2.7.17 ACCEPTANCE AND FINAL PAYMENT: When the Contractor shall have completed the work in accordance with the terms of the Contract Documents, the Engineer shall certify his acceptance to the Owner and his approval of the Contractor's final Request for Payment, which shall be the Contract Amount plus all approved additions less all approved deductions and less previous payments made. The Contractor shall furnish evidence that he has fully paid all debts for labor, materials, and equipment incurred in connection with the work, following which the Owner shall accept the work and release the Contractor except as to the conditions of the Performance Bond, any legal rights of the Owner, required guarantees, and Correction of Faulty Work after Final Payment, and shall authorize payment of the Contractor's final Request for Payment. The Contractor must allow sufficient time between the time of completion of the work and approval of the final Request for Payment for the Engineer to assemble and check the necessary data.

2.7.18 TERMINATION OF CONTRACTOR'S RESPONSIBILITY: The Contract will be considered complete when all work has been finished, the final inspection made by the Engineer, and the project accepted in writing by the Owner. The Contractor's responsibility shall then cease, except as set forth in his Performance Bond, as required by the Guaranty Period in accordance with Paragraph 2.4.09 and as provided in Paragraph 2.7.19.

2.7.19 CORRECTION OF FAULTY WORK AFTER FINAL PAYMENT: The approval of the final Request for Payment by the Engineer and the making of the final payment by the Owner to the Contractor shall not relieve the Contractor of responsibility for faulty materials or workmanship. The Owner shall promptly give notice of faulty materials or workmanship and the Contractor shall promptly replace any such defects discovered within one year from the date of written acceptance of the work. The Engineer shall decide all questions arising under this paragraph, and all such decisions shall be subject to arbitration.

SECTION 2.8 MODIFICATIONS OF GENERAL CONDITIONS

2.8.01 From Article 2.2.13a delete the words "signing of contract" and insert in lieu thereof the words "ordering the same".

2.8.02 To Article 2.7.05 add:

e. Failure of the Contractor to complete all work contracted for within the Contract Time. Payment by the Owner may be withheld in the amount of twenty-five dollars (\$25.00) for each calendar day the work remains uncompleted beyond the time stipulated for completion of the work, as amended by any extensions of time which may have been granted by the Owner.

2.8.03 In the event that construction progress should lag to such extent that the Engineer is required to perform his duties in servicing the construction after the completion date of the construction contract, the Contractor shall be liable for such additional engineering expenses at the rate of eight dollars (\$8.00) per hour for field engineer and/or sixteen dollars and fifty cents (\$16.50) per hour for a 3-man survey party, plus ten cents per mile for travel to, from, or on the project performed in the discharge of said engineering duties.

TECHNICAL PROVISIONS

GENERAL: LOCATION AND SCOPE OF WORK

The location of the work described herein is approximately 25 miles southwest of Rapid City, S. D., in Section 27, Township 2 South, Range 6 East, BHM. The work included hereunder is divided as follows:

SECTION A: Construction of a compacted earth fill dam requiring approximately 40,000 C.Y. of embankment above ground level and 3,800 C.Y. of excavation for a compacted clay core reaching to bedrock. Construction of a spillway excavated in bedrock. Construction of two 6" Parshall flumes to measure normal flow into and from the reservoir. Construction of a reservoir control pipeline, a water infiltration gallery and a pipeline from this gallery to a control or pump house. Construction of a pump house and the installation of pumps, chlorinator, meters, valves, piping and instruments as shown in plans and/or described in the specifications.

SECTION B: Construction of a water supply line from the pump house to a service storage tank.

SECTION C: Construction of a 50,000 gallon storage tank; either (Alternate No. 1) an elevated tank on a 120-foot tower, or (Alternate No. 2) a ground level steel tank at a location to give equal static pressure.

SECTION A

1. DAM

a. Source of materials for the dam is estimated to be as follows:

Select Clay: Approximately 7,000 C.Y. required; compacted volume.
500 C.Y. from core trench excavation.
1,500 C.Y. from borrow pits in reservoir basin.
5,000 C.Y. from clay pit one mile distant and 130 feet higher elevation (downhill haul).

Assorted embankment material:

Approximately 36,000 C.Y. required (compacted).
2,500 C.Y. from core trench excavation.
1,500 C.Y. from dam bed stripping (use in sodded slopes and top).
32,000 C.Y. from borrow pits in, and adjacent to, reservoir.
Estimated average haul will be about 600-700 feet.

Rock riprap: Approximately 880 C.Y. required. Test holes show borrow pits will contain a variable amount of random stones of all sizes. Since all stones over 3" diameter must be combed or bladed from the fill before compacting a current lift, it is possible that the amount of this material accumulated at the upstream slope of the fill will be sufficient for the riprap requirement. Any deficiency can be made up from rock waste from the spillway excavation or from gravel beds in the reservoir basin.

b. Site Preparation:

Below Elev. 4460 (full reservoir level) any open seams or fissures appearing in the granite abutment at the north end of the dam shall be sealed. All dirt, sand or loose material shall be removed by a high-pressure hydraulic stream and the crack sealed to a depth of at least 18" by concrete and/or cement grout containing an expansion or non-shrinking admixture approved by the Engineer. Only one open seam of any consequence is noted, this being slightly below Elev. 4460.

The bed of the dam shall be cleared of all trees, brush or other vegetation and sod; a portion of the latter being stock-piled for sodding the non-riprapped slopes of the dam. Boulders shall be broken up and placed contiguous to the downstream toe of the fill. No core trench or pipeline excavation under the dam shall be started until the bed of the dam has been cleared and stripped of topsoil. Trees, brush and slashings shall be removed and disposed of by burning, or otherwise, outside the reservoir basin. If burned, the Contractor will be responsible for keeping the fire confined to the brush pile and all embers thoroughly extinguished.

(1) Payment for clearing and grubbing trees and brush from the bed of the dam, including sealing of any rock seams, will be made at the lump sum amount bid for "dam site clearing and grubbing".

(2) The volume of sod stripping or un-usable overburden from the bed of the dam and/or from borrow pits will be determined from measurements of area and depth and payment will be made therefor at the unit price bid per cubic yard for "common excavation", which is herein defined as that excavated earthen material which must be wasted or cannot be used without re-handling.

c. Pipe Lines Under Dam:

These consist of a 12" cast iron line for reservoir control, a 6" cast iron line for pump supply from an infiltration gallery and a 3/8" O.D. copper tube for a static water level

recording gauge to be furnished and installed by the Owner. The control and supply lines shall be Class 150 cast iron pipe with mechanical bolted joints and compression gaskets. The gauge line shall be 3/8" O.D. copper tube, Type K, with flared compression fittings. The upstream 3' of the copper tube shall be drilled with 20 1/8" holes at about 1/4" C-C and this section wrapped with one turn of fine bronze or copper screen soldered to the tubing to prevent displacement when the line is back-flushed. The end of the pipe shall be sealed. The downstream end shall be carried around the inside wall of the pump house on suitable brackets or clamps to the location of the instrument panel with a straight 1/4" bronze needle valve 12" ahead of the terminus. Care shall be taken in bending the tubing, and in backfilling, to ensure that the tubing is free from any kinks that would prevent free flow and the line shall be tested for flow after backfilling. All lines under the dam shall be installed and the pump house floor, external walls and roof completed before dam embankment is placed.

Pipe lines shall be laid on tightly compacted bed material and in the same trench as close together as pipe bells will permit, except that downstream from the clay core, where the lines spread to enter the pump house, the Contractor may, at his option, use separate ditches for the cast iron lines. From the east side of the clay core section to the upstream cutoff collar the trench shall be excavated to firm, sound, bedded schist and the pipe laid thereon, as follows:

(1) The pipe shall be set on bricks or shims so that entire pipe weight is borne by the barrel and none by the bell or compression gland; or, bell holes of adequate size may be cut in the schist by pneumatic chisel in order to relieve the joints of any pipe weight, at the option of the Contractor. There shall be a minimum 3/4" space between the pipe barrels and bedrock. After assembly, the lines shall be tested for leaks by water pressure of 100 psi maintained for 30 minutes. Stiff, lean concrete, having a slump of approximately 2" and a minimum compressive strength of 1500 psi at 28 days, shall be firmly tamped under and around the pipe barrels to the mid-diameter of each pipe. Concrete for this purpose shall have maximum 1/2" aggregate to promote good workability under the pipe. This concrete bedding shall extend from the joint above the upstream concrete cutoff collar to the first joint below the downstream cutoff collar, near the dam centerline. The 6" supply line shall have a minimum 5' cover between the dam and infiltration gallery.

(2) The 12" reservoir control line shall have a screened inlet as shown on Sheet 17 of the plans. The concrete shall have a minimum compressive strength of 2000 psi at 28 days. Concrete used in the cutoff collars shall have a compressive strength of 3500 psi at 28 days. Welded grating of other characteristics may be used provided the mesh opening is no larger, and the bar thickness and total area of openings is at least equal to that shown. The grate shall have two coats of "Inertol", No. 66 Special Heavy, or three coats of "Inertol" Standard Thick Blac, or equal heavy-

bodied coal tar pitch coating.

(3) Pipe laid under the dam itself on material other than bedrock shall have adequate bell holes to relieve the joints of pipe weight. All pipe joints located between the upstream toe of the dam and the pump house shall be protected against future corrosion of the steel joint bolts by one of the following methods, at the option of the Contractor:

(a) The joints may be encased in a concrete jacket giving the bolts a minimum 1" of cover, or

(b) Each bolt to be given a coat of coal tar pitch base plastic material, equal to "Barrett" Service Cement, before assembly.

Then, after tightening and testing, each bolt and nut is to receive a heavy coat of service cement and the entire joint wrapped with 6" pipeline fabric, lapped and cemented over the top, to protect the service cement during backfilling. Backfill to the full depth of the pipe trench shall be compacted by mechanical means to not less than the density of contiguous, undisturbed soil.

(4) The infiltration gallery line at the head of the 6" cast iron supply line shall be 120 lineal feet of standard weight, 12" perforated vitrified clay pipe, conforming to ASTM Designation C211-57T, or latest revision thereof, having six rows of 1/4" holes spaced approximately 3" center to center along the rows.

(5) The black earth overburden shall be stripped from the sand-and-gravel deposit at the infiltration gallery location for a width of 15 feet each side of the centerline. This material shall be stockpiled above high water level for later use by others. The perforated clay pipe shall be laid with the perforations down and bedded in coarse gravel so that no weight rests on the pipe bells, with the bells pointed "up-grade". The spigot ends shall be truly centered in the bells and firmly seated against the shoulder of the sockets. The gravel cushion under the pipe, and the backfill material to a depth of 6" over the pipe, shall be minimum 3/4" size, either screened from the material in place at the site or crushed rock hauled for that purpose. If crushed rock is used, it shall be of a granitic or quartzose type, free from lime or any minerals soluble in water at 60° F. Backfill to a depth of 6' above the pipe and to the width of the stripped areas is to be made with the sand-and-gravel mixture, free from topsoil, in place at the site. The riser stack at the north end of the infiltration gallery shall be of standard 12" vitrified clay sewer pipe, non-perforated.

(6) The 12" cast iron control line will be measured by the lineal foot from its upstream end to the flanged joint at the upstream 12" valve and payment will be made therefor at the unit price bid per lineal foot for this item, which shall include all materials and work of installing the 12" line, concrete cutoff

collars and screened inlet box. The 32' run of 12" pipe downstream from the 11 $\frac{1}{2}$ bend in the pump house is included in another item.

(7) The 6" pump supply line will be measured by the lineal foot of pipe from its head, at the infiltration gallery, to the flanged joint inside the west wall of the pump house and payment will be made therefor at the unit price bid per lineal foot for this item, which shall include all materials and work of installing the same.

(8) The 3/8" O.D. copper gauge line will be measured by the lineal foot of such line installed in place, including specified fittings, and will be paid for at the unit price bid for this item.

(9) The 12" infiltration gallery line will be measured by the lineal foot of such pipe laid and shall include all material and work of installing the same, including backfill with specified material and the vertical stack at the north end of the gallery, and will be paid for at the unit price bid for this item. Stripping of black dirt above the line will be paid for as "common excavation".

3. Core Trench Excavation:

Core trench excavation shall be carried down through the thin layer of weathered schist to firm, bedded schist. The work may be so scheduled that suitable material excavated from the central and south portions of the trench may be used in the northerly portion of the work without re-handling. The clay backfill material shall not be laid down until the surface of the exposed schist is free from significant amounts of granular type material. The material shall, if required, be wetted to near optimum moisture content and compacted with a sheepsfoot roller. The roller for both core and embankment compaction shall be equal to that required by the South Dakota Department of Highways for earthwork compaction; namely, one having teeth or studs not less than 6" long and a weight, when filled, adequate to transmit a pressure of not less than 550 pounds per square inch to the end surface of the studs.

Core trench backfill shall be placed in lifts approximately 8" thick (loose measure) and rolled until the studs, with the roller in motion, do not penetrate more than about 1/4"; a degree of compaction ranging from 90 to 95 percent of maximum dry density, as measured by AASHTO Method T99-49. Compaction around pipes, cutoff collar, or granite cliff in areas inaccessible to sheepsfoot roller shall be by mechanical means capable of obtaining the same degree of compaction.

Core trench backfill will be measured by the cubic yard of material in place and shall include excavating, hauling from adjacent borrow pits and processing in place. Payment will be

made therefor at the unit price bid per cubic yard for this item.

Clay overhaul from a clay pit one mile distant will be measured by the cubic yard of material hauled out as determined by pit measurements made after pit stripping and after termination of such excavation. Payment will be made for clay overhaul at the unit price bid for this item.

e. Embankment:

Material for embankment shall be placed in the fill with the densest and most impervious material at the center of the dam, graduating in degree of water-tightness to the outer slopes, as shown on Sheet 15 of the plans. The material shall be placed in lifts of nominal 8" loose thickness. All stones larger than 3" shall be raked or "combed" out by scarifier or other means and removed before compacting the lift. Stones so removed may be left at the upstream edge of the fill to be used as riprap.

Water shall be added, if required, to bring the moisture content of the material to near optimum and the lift rolled until the roller studs, in motion, do not penetrate more than approximately $1\frac{1}{4}$ ".

The downstream slope, the top and the upstream slope above Elev. 4465 shall be sodded with topsoil 12" thick, this material being compacted and considered as "embankment in place". The embankment shall be cambered so that the actual finished elevation of the top at any point will exceed the depth of fill below Elev. 4470 at that point by $2\frac{1}{2}$ percent, to guard against possible loss of freeboard by future settlement.

Embankment will be measured by cubic yard of finished embankment constructed and shall include excavating, hauling from pits in or adjacent to the reservoir and processing the material in place. Payment will be made therefor at the unit price bid per cubic yard for this item. Haulage of material for the embankment from a clay pit one mile distant will be paid for at the unit price bid per cubic yard for "clay overhaul".

f. Spillway:

The material in place at the spillway location is firmly bedded schist. Careful examination of the surface shows no evidence of open seams or fissures. Although the material has easy drilling and "free-shooting" characteristics, it is not anticipated that any timbering will be required. Should any open seams or fissures be encountered they shall be sealed with non-shrinking mortar or grout as directed by the Engineer, this being considered as "extra work" to be paid for as hereinafter outlined.

The entrance and drop section of the spillway will be in open cut. A concrete lip or nosing shall be constructed at the entrance as shown in the plans to improve its hydraulic value.

Special care shall be taken to follow the design vertical curve of the drop section surface very closely. The finished surface in this section shall average within one inch of the design shape, all protruding knobs or bulges being cut back with an air chisel or other tool. In tunnel excavation the area of any cross section shall not be less than the design cross section at that point, and the surfaces shall be reasonably free from irregularities which would produce turbulent flow. Any such bulges or knobs shall be removed with an air chisel or other tool when so directed by the Engineer.

The location of the downstream transition from tunnel to open cut will be determined by the Engineer from conditions revealed by the tailrace excavation. Rock from the entrance open cut may be wasted outside the upstream toe of the embankment or used as riprap on the dam. Rock from the downstream open cut and tunnel excavation shall be wasted against the downstream toe of the dam in the area northward from the south side of the creek channel.

Open cut rock excavation will be measured by the cubic yard volume of the open cut, design width, and payment therefor will be made at the unit price bid per cubic yard for "rock excavation: open cut", which shall include the small concrete entrance lip.

Rock excavation, tunnel, will be measured by the cubic yard volume of the tunnel excavated to design cross section and payment therefor will be made at the unit price bid for "rock excavation: tunnel".

The entrance to the spillway shall be protected by a trash rack of welded steel bars anchored in place by eyebolts set in rock as shown on Sheet 16 or the plans. After assembly the welds shall be wire-brushed and the steel given a coat of "Inertol" Quick-Dry Primer No. 626 and two coats of "Inertol" Bakelite Resin Aluminum No. 5504. Payment for the trash rack will be made at the lump sum amount bid for this item.

g. Riprap:

The upstream face of the dam shall be riprapped, from the toe of the embankment to Elev. 4465, with rock placed on a 2" blanket of gravel; the combined thickness of rock and gravel to be not less than 9". The gradation of the rock shall be such that the spaces between the larger stones is well filled with smaller fragments.

Riprap will be paid for at the unit price per cubic yard bid for this item in place, computed on the basis of a layer 9" thick covering the measured surface area.

h. Seeding:

The top and slope areas of the dam not covered by riprap

shall be seeded with crested wheat grass, Fairway Strain (*Agropyron Cristatum*), drilled in at the rate of 20 pounds of live grass seed per acre. The seed bags or containers shall carry a vendor's tag or label setting forth the type of grass, percent of germination and percentage of foreign material for the seed furnished; or, the Contractor shall furnish a certified statement from the vendor attesting to the above characteristics of the seed furnished. The seeding shall be done in conformity with accepted good agricultural practice with regard to season, moisture in the soil and seeding equipment. Payment for seeding will be made at the lump sum amount bid for this item.

2. PUMP HOUSE

a. Structural:

Concrete used in construction of the pump house shall have a minimum compressive strength in 28 days as follows:

Floor slab: 3,000 pounds per square inch

Roof slab: 3,500 pounds per square inch

Reinforcing bars shall be free of oil, grease or heavy rust, properly bent and placed as shown in the plans and care shall be taken to insure that the steel is not moved from its design position during placement of concrete.

When placing concrete it shall be thoroughly agitated or spudded, preferably with a mechanical vibrator, to release entrapped air and increase its density and bond on reinforcing steel.

Roof soffit block shall be thoroughly wetted immediately prior to placing the concrete.

Exposed concrete shall be moist-cured for not less than seven days after placement by covering with burlap or moist earth and sprinkling, or by spraying it, after initial set, with an approved concrete curing compound.

Centering or support framing shall not be removed from under the roof slab until it has been properly cured for at least 15 days, and no load should be placed on the roof until after 28 days. The top of the roof slab shall be crowned 1/2" across the 14-foot dimension by thickening the cover concrete at the center. The inner surface of the roof deck shall not be crowned, but remain level.

Masonry block shall be laid up with each course solidly bedded in mortar with vertical joints breaking half way between those of the preceding course and mortared the entire height of the masonry unit, using mortar made from one part commercial masonry cement and not more than 2-3/4 parts clean sharp sand.

All exposed joints shall be tooled. The masonry walls shall be kept clean of mortar spatter as the work progresses.

Non-mechanical ventilators shall be of the grille-and-damper type with inside control of the damper from "open" to "closed" position. It shall be of the type to lay up in the wall and occupy the space of one masonry block or two glass block.

The doorway of the chlorinator room shall have a doorsill embodying an extruded plastic type of weatherstop. The sides and top of the door frame shall have a cemented-on type of sponge rubber weatherstrip. All openings made in the partition wall between the chlorinator room and pump room, for wiring or piping, shall be sealed with gray mastic caulking compound before painting.

Electrical power: 110 and 220 volts, 3-phase, 60-cycle. Power will be delivered to the pump house by the utility company. All other electrical equipment and material shall be furnished and installed by the Contractor. All electrical wiring shall be in conduit and shall conform to the National Electrical Code. Power leads shall have outside lightning arresters equal to Westinghouse 825-552.

The outside walls below grade shall have a heavy coat of Foundation Coating #833 as sold by Dakota Lime and Brick Co. Exposed outside walls: One coat Cook's "Cling Block Filler" plus one coat Cook's "A-KRYL-X" acrylic latex paint, or equal, white. Roof: Two coats "A-KRYL-X", white. Interior walls: Two coats Cook's "Corovel", or equal, cream color. Floor: Two coats Cook's "Cling Cement Floor Coat", or equal, gray.

Payment for the pump house structure shown in plans and/or described under paragraph 2, subparagraph a., Section A, above, entitled "Structural", will be made in the lump sum amount bid for this item.

b. Pumps:

Two pumps shall be installed, each having a capacity of 120 GPM at 330 feet TDH. They shall be of the horizontal, direct-drive, flex-coupled type, having a non-rigid drive shaft connection between the motor and the impeller section. The plans show a type of pump having an end-suction and side-bottom discharge flow pattern. Bidders proposing pumps with different flow patterns, such as an opposed suction-discharge arrangement, shall submit a drawing of their proposed piping diagram for such pumps from the metered pump supply line to the common junction with the 6" supply line to the storage tank. Such alternate piping arrangement shall have a friction loss no greater than that shown in the plans.

The pumps will be given a pumping test after installation. The test shall be performed by the Contractor under supervision

of the Engineer. Services of the pump manufacturer's representative shall be made available, without cost to the Owner, to insure that the pumps are installed and functioning properly. An operation and maintenance manual and parts list for the pumps installed shall be furnished the Owner without charge.

Bidders shall submit full informative data on the pumps they propose to furnish, including performance curves, horsepower requirements and installation dimensions. The pumps will have a positive head on the suction side ranging from $1\frac{1}{2}$ feet to 25 feet, according to level of water in the reservoir.

c. Pump Controls:

Motor starters for the pumps shall be across-the-line type equal to Allen-Bradley Bulletin 712 series, fused, with overload and low voltage protection, these starters to be actuated by the controls described hereinafter. The storage tank water level control transmitter shall be a Healy-Ruff "Rototrol", Type C, with adjustable time delay on Start and Stop, as manufactured by the Healy-Ruff Co., 2255 University Ave., St. Paul 14, Minnesota, or equal, approved by the Engineer. This is to be actuated by a $\frac{3}{8}$ " copper line to carry static water pressure from the tank. It shall be for a static head range of 300 to 330 feet of water.

The automatic alternator shall be a Healy-Ruff "Altitrol" for two pumps. There shall be a 1-to-2 minute time delay device in the circuit to Pump No. 2, equal to Allen-Bradley Bulletin 849, ZAA series. All the above to be in Nema I enclosures. Equal equipment of other manufacturers may be used if approved by the Engineer after submission of full descriptive literature and specifications.

A three-station selector shall be provided, with the stations designated "Pump 1", "Pump 2", and "Alt. Bypass", each with "OFF-HAND-AUTO". The performance characteristics of the control circuiting shall be such that the following pumping programs may be selected at the option of the operator

(1) Program 1: Upon "Start" signal from transmitter to receiver, one pump will operate until shut off by a "Stop" signal; the sequence of operating being automatically alternated between the two pumps.

(2) Program 2: Upon "Start" signal from transmitter to receiver, both pumps will operate until shut off by a "Stop" signal, with Pump No. 2 starting approximately one minute later than Pump No. 1.

(3) Program 3: Either pump may be started or stopped or removed from automatic control manually for the purpose of testing or repair. An "as built" wiring diagram of pump control circuits shall be furnished the Owner without charge.

Payment for "pumps in place" shall include furnishing, in-

stalling and testing the equipment shown in the plans and/or described under paragraph 2, subparagraphs b and c, Section A, above.

d. Meters:

(1) Meters shall be installed in the 4" auxiliary reservoir control line for the release of small flows from the reservoir and in the 4" line ahead of the pumps. They shall be 4" flanged "Sparling Tube Meters", No. 245, or equal, approved by the Engineer. Each shall have an Indicator-Totalizer dial indicating the rate of flow in gallons per minute and the total flow in units of 1,000 gallons.

Flanged tube meters will be paid for at the unit price, each, bid for this item, installed in place.

(2) Control Valve and Screen: The 4" auxiliary control line shall have installed, where shown, a Y-pattern sediment separator to protect the meter, the separator being Crane No. 989 $\frac{1}{2}$, or equal, approved by the Engineer. It shall be installed immediately downstream from the regulating valve which shall be a rubber-faced, eccentric-plug type valve, gear operated to hold any desired setting, equal to "DeZurick" No. 101FWG, capable of passing sediment-laden water at any degree of closure without undue wear on seat or plug.

e. Chlorinator:

The chlorinator shall be Wallace & Tiernan, Series A-741, wall-mounted, gas feed type, with 10% per day rotameter, injector, water pressure gauge and a full set of operation and maintenance instructions. The point of chlorine application shall be in the pump supply line ahead of the pump suction, which shall be tapped to receive the feed fitting. A 3/4" tap shall be made in the 6" supply line leading to the storage tank and a 3/4" copper tube line run from this point to serve a hose bibb on the pumphouse wall where shown and a water supply to the chlorinator. Chlorinator equipment shall include all necessary solution tubing, valves, cocks or other fittings required to make proper installation of the equipment. Installation and testing of the equipment shall be done under the supervision of the manufacturer's representative. A compact platform scale of 1,000-pound capacity and a chlorine testing kit, with comparator scale and supply of orthotolodine, shall be furnished as accessory equipment. The chlorinator control shall be wired to start the chlorinator when either or both pumps are started and stopped at the end of the pumping cycle. Setting of the chlorine feed rate to be done manually, according to the pumping program selected by the operator. A motor-driven exhaust fan ventilator, with a minimum air capacity of 500 CFM, equal to Prync #2206, shall be installed in the chlorinator room and wired in circuit with the light switch for the chlorinator room which shall be located outside the room. The fan shall be installed at floor level to draw air from floor level and discharge through a swinging-dampered duct in the south wall of the building.

Payment for the chlorinator shall include furnishing, installing and testing, complete in place and ready for use, the equipment outlined in paragraph 2, subparagraph e, Section A, above.

f. Heaters:

Heaters shall be of the electric, blower type and capacity shown in the plans and equipped with thermostatic control. Equal heaters of other manufacture than that shown may be used, if approved by the Engineer.

g. Valves and Piping:

Valves in the pump supply and reservoir control lines, other than the 4" regulating valve, shall be iron body, bronze mounted, double disc gate valves with non-rising stems, faced and drilled 125-pound standard. All gate valves and check valves in the discharge lines from the pumps, or subject to hydrostatic pressure from the storage tank supply line, shall be designed, faced and drilled 250-pound standard. The check valves shall be iron body, bronze mounted, swing-gate type, with removable top plate and flow direction arrow cast or stamped thereon. All valves shall have their WOG operating pressure rating cast or stamped in the body of the valve. Gate valves shall be so constructed that they may be repacked, when wide open, under full rated pressure.

All cast iron pipe used in the reservoir control or pump supply lines shall be Class 150; all cast iron pipe used in the 6" supply line to the storage tank shall be Class 200. Exposed piping, smaller than 12", inside the pump house may be cast iron or galvanized steel pipe, at the Contractor's option. Cast iron pipes passing through rigid walls shall either

(1) Have a bolted mechanical joint within two feet of the external wall, or

(2) The length of pipe rigidly fixed in the wall shall be bedded in concrete from the wall to the first mechanical joint, as specified for a portion of the pipe lines under the dam.

All exposed valves and piping in the pumphouse, other than copper tube, shall be painted with two coats of good metal paint approved by the Engineer; low pressure lines, green, and high pressure lines, red.

The item "Miscellaneous Pump House Valves, Piping and Equipment" shall include furnishing and installing of all valves, piping, fittings and other equipment shown on Sheet 18 of the plans and/or described under paragraph 2, subparagraphs d2, f and g, Section A, above, and also the discharge section of 12" cast iron reservoir control line terminating in open ditch 32 feet from the downstream flange of the 11 $\frac{1}{2}$ " bend shown. Payment for this "Miscellaneous" item will be made in the lump sum amount bid for the item.

SECTION B

1. WATER SUPPLY PIPELINE

a. Cast iron pipe and fittings shall conform to Federal Specification WW-P-421 or A.S.A. Specification A21.8. Asbestos-cement pipe shall conform to Federal Specification SS-P-351 or AWWA Specification C-400-53T. Copper tube, for the static water pressure gauge line, shall be Type K, conforming to ASTM Designation B88, for underground service.

b. Gate valves shall be iron body, double disc, bronze or bronze mounted, non-rising stem, double hub type except that auxiliary gate valves installed at fire hydrants shall have one flanged and one hub end. Gate valves shall open by turning in a counter-clockwise direction and shall be so marked with an arrow cast on the operating nut. All valves shall be designed for a working pressure of not less than that of the line where installed, and shall have a pressure rating, maker's initials, and year of manufacture cast upon the body.

Each gate valve shall be equipped with a cast iron valve box having a barrel or not less than 5" inside diameter. The box shall have a screwed sleeve or top section so that the length of the barrel may be adjusted to bring the top to the proper grade. It shall be equipped with a loose cast iron cover marked "WATER".

c. Construction Methods:

(1) Excavation and Trenching: The ground shall be excavated in open trench to the width, depth and alignment necessary for the proper construction of the water main except where tunneling is considered necessary or proper by the Engineer and approved by him in writing.

If, through neglect of the Contractor to adequately shore a trench or properly unwater it, the bottom of the trench becomes an unstable foundation for the pipe in the opinion of the Engineer, the Contractor shall remove such unstable material and replace it with compacted gravel at his own expense.

However, if the undisturbed material encountered at grade depth constitutes an unstable foundation for the pipe, in the opinion of the Engineer, he may require the removal of such unstable material and replacement of the same by compacted gravel. Compensation will be paid to the Contractor at the cost-plus rate bid for performing "Extra Work".

If ledge rock is encountered in the excavation, it shall be removed to a level 6" below the grade of the pipe. The Contractor shall not remove the rock until its elevation or profile has been recorded by the Engineer. A 6" cushion of compacted earth shall be placed over the rock before any pipe is laid on it. If the rock is removed by blasting, proper safeguards shall be employed to prevent injury to persons or property and the blasting shall

be done only by one experienced in such work. Compensation will be paid to the Contractor for such ledge rock excavation at the bid price for this item.

Ledge rock is defined as solid rock formations or dislodged boulders of not less than 16 cubic feet in volume. Shale, cemented gravel, or similar formations shall not qualify as "ledge rock" even though mechanical breakers or explosives may be required for their removal. Measurement by the Engineer shall be made of the profiles or volumes of the rock as it is removed, but no measurement shall be allowed for ledge rock less than 6" in thickness.

Hard-pan, stiff clay, compacted sand, and similar materials, normally considered by the trade as "difficult digging", shall not qualify for extra payment, nor shall quicksand or the presence of strong flows of ground water, these difficulties being considered to be the normal hazards incidental to the business.

Where directed by the Engineer, the sides of the trenches shall be shored in an approved manner with wood sheeting not less than 2" thick, or with steel sheeting of equal strength.

The Contractor will be responsible for any injury to persons or property resulting from failure to adequately shore any trench, whether or not the placing of such shoring was directed by the Engineer.

During excavation of the trenches, the Contractor shall exercise due care to preserve all stakes set by the Engineer and to avoid all injury to such gas, water, sanitary, electrical or communications utilities as may be encountered in the course of the work. Any damage done to such utilities by the Contractor shall be promptly repaired by him at his own expense. Construction stakes destroyed by the Contractor will be replaced by the Engineer at the Contractor's expense.

Trench excavation shall be carried to sufficient depth to provide an earth cover of not less than 6' above the top of the pipe.

Bell holes shall be adequate to allow for good workmanship in making up the joints.

(2) Pipe Laying:

The interior of all the pipes and fittings shall be thoroughly cleaned of all foreign matter before being lowered into the trench, and due precautions shall be taken to prevent the entrance of ditch water into the pipe or fittings. Pipe shall not be dropped into the trench from the bank above, but shall be lowered in a manner to prevent injury to the pipe.

Deflections from a straight line due to vertical or horizontal curves or offsets shall not exceed, for any one joint,

the maximum recommended by the manufacturer of the type of pipe being laid.

If the alignment requires a deflection in excess of that given above, the Contractor will either provide a special bend or a sufficient number of shorter length of pipe so that the deflection at any joint shall not exceed the specified maximum.

All bends of $22\frac{1}{2}^{\circ}$ or more shall be anchored by concrete thrust blocks. Concrete thrust blocks shall bear squarely against the firm, undisturbed soil of the side of the trench. The minimum thrust bearing area of the blocks shall be equal to six times the cross-sectional area of the pipe, in the case of 90° bends and tees, and four times the cross-sectional area of the pipe in the case of 45° or flatter bends.

Mechanical joints shall be coupled and secured in strict accordance with the manufacturer's recommendation and in a manner that will insure a permanent and watertight seal.

All cast iron pipe shall be laid on a firm, full bedding for the length of the barrel.

Cement-asbestos pipe shall be laid, in the properly graded trench, supported at the support points marked on the pipe approximately $\frac{1}{5}$ the length of the pipe from each end. Immediately after coupling and aligning the pipe, the space under the pipe barrel and up to the horizontal axis of the pipe shall be backfilled and thoroughly tamped to form a firm and uniform bed for the pipe. Installation shall be strictly in accordance with the manufacturer's installation manual, with special care given to proper bedding of the pipe.

(3) Valves and Valve Boxes: The valves shall be thoroughly inspected and cleaned before installing. The valve shall be installed with the operating nut in a truly vertical position.

The valve box shall be set plumb and centered over the operation nut and shall be kept in that position during backfilling. If the valve box is off center after backfilling so as to cause any binding of the valve operating wrench, the assembly shall be taken up and properly installed at the Contractor's expense.

(4) Tests: All joints in pipe lines shall remain uncovered until the line has been subjected to a pressure test and found acceptable. Lines, including copper gauge line, will be tested in increments of 600' and 800', where feasible. The line to be tested shall be subjected to a water pressure of 150 pounds per square inch for Class 150 pipe and 200 pounds per square inch for Class 200 lines, and the pressure maintained for one hour by pumping measured amounts of water into the line. The leakage rate shall not exceed 80 gallons per inch of pipe diameter per mile of length per 24 hours. Any pipe, fittings or valves found to be defective shall be removed and replaced with sound units.

(5) Backfilling: When starting the backfill due care shall be taken to insure that each pipe is solidly bedded for its full length so it will not be subjected to beam action by settlement of the backfill. No large stones or boulders shall be placed within three inches of the pipe. The backfill may be consolidated by application of water, but flooding or puddling of the backfill will not be allowed unless, in the opinion of the Engineer, the soil surrounding the pipe is sufficiently porous or gravelly to permit such procedure without rendering it unstable. Special care shall be taken to bed and backfill the copper gauge line in such manner that it will not be kinked in a manner to impede free flow. All stones four inches or larger removed from the trench during excavation shall be replaced in the backfill below the ground surface. Any such stones remaining on the surface after the backfill is completed shall be disposed of as directed by the Engineer.

The backfill of all trenches shall be finished by smoothly mounding the surplus material over the trench and rolling it down to cause a minimum of inconvenience to traffic.

(6) Pipe Line from Tank Site #1 to Tank Site #2: If Alternate No. 2 Tank is chosen by the Owner it will involve much ledge rock excavation in the upper portion of the line, some of which is difficult of access. The rock waste will not be suitable for backfill over the pipe and earth shall be hauled for cushioning the pipe and for backfill. After the pipe has been covered with earth to specified depth the waste rock from the rock excavation shall be spread back over the backfilled trench to prevent erosion of the earth backfill, which shall be included in the price bid for earth hauled and placed.

(7) Miscellaneous: All surplus earth or stone removed during excavation shall be disposed of as directed by the Engineer. Materials and equipment used in construction shall be neatly piled or stored in such location and manner as not to impede vehicular traffic as far as practicable; and the work of construction shall be conducted in such a manner as to minimize inconvenience to such traffic. The Contractor will take all proper measures, such as the use of barricades, flares, warning signs or flags to safeguard public travel on or about the project.

d. Measurement and Payment:

(1) Pipe lines shall be measured for payment as the actual survey length for each size and class of pipe actually laid during construction and accepted by the Engineer. Bends, tees or other fittings will be included and considered as "lineal feet of pipe".

(2) Gate valves shall be measured as units of each size, actually installed and including the valve and valve box complete in place and accepted by the Engineer.

(3) Ledge rock excavation shall be measured as the net volume between the upper and lower profiles of the stratum or be-

tween the upper profile of the rock formation and a line 6" below the pipe invert, and a maximum width of the external diameter of the pipe barrel plus 20", or minimum of 30", whichever is larger.

(4) Earth backfill, hauled and placed shall be measured as the actual cubic yards of compacted earth in place which has been hauled and placed in lieu of unsatisfactory excavated material.

(5) Payment shall be made at the unit price bid for the several items listed in the proposal for the quantity actually used in the accepted work. Such payment shall constitute full compensation for furnishing all materials, equipment and tools; for furnishing all labor; for performing all the work; and for incidentals necessary to complete the project complete in place and ready for use in conformity with the plans and specifications.

SECTION C

1. 50,000 GALLON STEEL STORAGE TANK

a. Alternate No. 1 - Elevated Tank at Site No. 1:

(1) The tank shall be of the pedestal-sphere type having a pedestal support 120 feet in height supporting a spherical or spheroid-shaped tank. Since various tank manufacturers have their individual patterns and dimensions, the bidder shall submit two outline drawings of the structure he proposes to erect, one of which will be returned after review and approval by the Engineer. After award of contract, the Contractor shall furnish the Engineer with two sets of shop drawings for the structure, one of which will be returned after review and approval by the Engineer. The general design, design loads, allowable stresses, weld design and welding practice, shop fabrication and field erection practices, and all materials used, shall be in accordance with the latest "Standard Specifications for Elevated Steel Water Tanks, Standpipes and Reservoirs" of the American Waterworks Association.

(2) The lump sum price bid for this item shall include all fabrication and erection of the tank on adequate foundations and painting; complete in place and ready for use.

b. Alternate No. 2 - Ground Level Steel Tank at Tank Site No. 2:

(1) Details showing the desired dimensions and other details of this tank are shown on Sheet 17 of the plans. Dimensions shown may be altered slightly to fit the maker's fabrication technique, if desired, after approval of such alteration by the Engineer. The site shall be leveled by blasting and/or pneumatic tools to a comparatively true surface and a 6" compacted oiled sand cushion laid down to support the tank bottom. The sand cushion shall extend at least 8" outside the bottom stiffener angle and the edges of the cushion shall be protected from wash by waste rock piled about the outer edge.

(2) After notice of award of contract, and before construction is begun, the successful bidder shall submit to the Engineer two sets of detailed construction drawings of the reservoir, one of which will be returned after review and approval by the Engineer.

(3) The general design, the design loadings, allowable stresses, weld design and welding practice, shop fabrication and field erection practices and all materials used in the construction shall be in accordance with the latest "Standard Specifications for Elevated Steel Water Tanks, Standpipes and Reservoirs" of the American Waterworks Association.

(4) Pipe connections for one 6" cast iron pipe shall be provided, welded or brazed in place, in the bottom plates. It shall be of the gland, or compression ring, type.

(5) An outside vertical ladder shall be provided, designed to support at least 600 pounds at any one point. The ladder shall have no backward slope at any point unless a safety cage is provided. A roof ladder shall be installed to facilitate inspection and/or repainting of the roof. It shall provide access from the outside vertical ladder to the center of the roof and shall be rotatable completely about the roof. It may rotate about an ornamental roof finial or a gudgeon pin provided for that purpose. The roof shall be entirely self-supporting.

(6) A hinged roof hatch shall be provided above the high water line and within reach of the outside ladder. It shall have a clear opening of not less than 20" with a curb around the same. The cover shall overlap and extend down over the outside of the curb not less than $1\frac{1}{2}$ " and shall be fitted with a suitable hasp for padlocking.

(7) A 4" screened overflow pipe shall be provided. The screen shall be bronze or copper, soldered to the down-turned elbow.

(8) Welding:

(a) Welds in the bottom plates may be lap or butt welds. If butt welds, the inside edges of the plates shall be beveled and a sufficient number of passes made to build the weld bead to full size. Each pass shall be cleaned by wire brushing or chipping to live metal before making a succeeding pass.

(b) Seams in the shell plates shall be butt welded on both sides. On vertical seams the reverse side of the initial bead shall be wire brushed or chipped to expose live metal of the initial bead before depositing the opposite bead.

(9) Painting:

(a) After the bottom welding is completed, the welds shall be cleaned and tested for leaks with soap solution and a vacuum plate. After completing the bottom pipe connection and at least one course of shell plates to give weight to the outer rim, the under side of the tank bottom shall be sealed by forcing a bituminous base caulking mastic into the $1/2$ " pipe connection, provided in the center of the bottom for that purpose, until the mastic shows at the $1/4$ " telltale holes in the periphery of the bottom stiffener angle. As the mastic shows at these holes they shall be plugged with $1/4$ " pipe plugs until sealing is complete.

(b) All rust, dirt, oil, grease, welding scale or loose mill scale or shop coat paint shall be removed from steel surfaces by wire brushing or chipping before any paint is applied.

(c) The underside of the bottom plates shall be given a cold-applied coating of coal tar pitch varnish before laying on grade. They shall be laid on grade and welded in place

with as little handling as possible to avoid damage to the varnish coating.

(d) The inside of the reservoir bottom, shell, roof (and roof framing, if any) shall be painted one prime coat of A.W.W.A. Specification red lead, linseed oil paint or zinc chromate oxide primer, or equal, and one finish coat of A.W.W.A. Specification red lead, linseed oil paint or Inertol No. 55 interior tank coating, or equal.

(e) The outside of the reservoir shell, roof and external accessories shall be painted one prime coat of A.W.W.A. Specification red lead, linseed oil paint or zinc chromate oxide primer, or equal, and two finish coats of aluminum paint containing two pounds of aluminum-pigment powder and paste per gallon of aluminum mixing vehicle.

(f) All ingredients of the above paints shall conform to the latest A.S.T.M. Specifications. All paints and mixing ingredients shall be delivered to the reservoir site in sealed containers which shall be clearly labeled with the manufacturer's name and the type of paint each contains. Paints shall be applied strictly in accordance with the manufacturer's instructions.

(g) Paint may be applied by brush or pneumatic spray gun. If sprayed, it shall be brushed out and worked into all crevices and corners, where necessary, to obtain a finish equal to first-class brush painting. No paint shall be applied when the metal is wet, or too hot or too cold to obtain a first-class job. Sufficient time shall be allowed for each coat to dry before a succeeding coat is applied. The finished appearance shall be free from cracks, runs, blisters, crazing or other defects.

(10) Testing:

(a) After construction and painting of the reservoir is completed, it shall be filled to the high water line. Any leaks that are disclosed shall be repaired by the Contractor. No repair shall be made on any shell joint unless the water in the reservoir is at least 2' below the point being repaired.

(b) Upon completion of work the Contractor shall remove or dispose of all rubbish caused by, or incidental to, his operation.

(11) Payment: Section 2.7, paragraph 2.7.02 of the General Conditions, herein, are abridged and modified as follows: Fifty percent (50%) of the bid price will be paid to the Contractor upon delivery of the steel to the site and the balance on completion of the work. The Contractor shall furnish the Engineer with the necessary invoices, etc., to properly document his claims for the first payment.

TECHNICAL SPECIFICATIONS
FOR
BLACK HILLS BILTMORE
WATER SUPPLY SYSTEM

* * *

Staven Engineering Company
Rapid City, South Dakota

March, 1962

NOTICE TO CONTRACTORS

Sealed proposals will be received until 2:00 P.M., May 4, 1962, by UMD Company, care of Demco, Incorporated, P. O. Box 2072, Rapid City, South Dakota or delivered to Staven Engineering Company, Deadwood Avenue, Rapid City, South Dakota, for the construction of a Water Supply System and a Sewage System at the Black Hills Biltmore Resort located near Iron Mountain, approximately 25 miles Southeast of Rapid City, South Dakota.

The work in general consists of:

Water System. A compacted earth and rock fill dam, spillway, pump house, pumps, Chlorinator, controls, 5,200 L.F. of cast iron and cement asbestos pipe, a 50,000 gallon storage tank.

Sewage System. 5,000 L.F. of sanitary sewer, a lift station, and a sewage treatment lagoon.

No bid security will be required.

No plans deposit will be required.

Plans will be on file at Building Exchanges at Rapid City and Sioux Falls, South Dakota.

Plans and Specifications may be obtained from Staven Engineering Company, Phone 343-0222, P. O. Box 1072, Rapid City, South Dakota.

INSTRUCTIONS TO BIDDERS

GENERAL CONTRACT: The general contract for the construction of the complete facilities at Black Hills Biltmore Resort has been negotiated by and between the Black Hills Biltmore Corporation and the UMD Company, a joint venture consisting of United Builders, Incorporated, Shawnee, Oklahoma; Mack Construction Company, Independence, Missouri; and Demco, Incorporated, Rapid City, South Dakota.

The complete facilities will include motel units, a central lodge building, a golf course, swimming pool, ski slope and tow, and other miscellaneous work in addition to the Water Supply System and the Sewage System. At the present time, only the water and sewage facilities are ready for construction.

PROPOSALS FOR SUBCONTRACTS: The UMD Company is asking for proposals for subcontracts for the construction of the Water Supply System and Sewage System as explained in the "Notice to Contractors".

Bids will be received on and according to the "Bid Schedule" attached to the specifications.

Bidders may prepare proposals on all or any number of the sections of the bid schedules, however proposals on individual items of any section will not be considered.

All bids shall be submitted in sealed envelopes bearing on the outside the name of the bidder, time of letting, and the project name.

Each bidder agrees that he will enter into a contract with the UMD Company for the work described in the bid and will furnish a 100% Performance and Payment Bond within 15 days from the time of receipt of bids.

STAVEN ENGINEERING COMPANY

TECHNICAL PROVISIONS

GENERAL: LOCATION AND SCOPE OF WORK

The location of the work described herein is approximately 25 miles southwest of Rapid City, S. D., in Section 27, Township 2 South, Range 6 East, BHM. The work included hereunder is divided as follows:

SECTION A: Construction of a dam having a composite cross section; the upstream section being a rolled earth fill with 3:1 slope; the downstream section being a stone and gravel fill with 1:1 slope, consolidated by hydraulic means. Construction of a water cutoff diaphragm extending from bedrock to the top of the dam, of corrugated, interlocking, galvanized sheet steel piling, 7 gage thickness, and construction of a spillway, all as described hereinafter. Construction of two 6" Parshall flumes to measure normal flow into and from the reservoir. Construction of a reservoir control pipeline, a water infiltration gallery and a pipeline from this gallery to a control or pump house. Construction of a pump house and the installation of pumps, chlorinator, meters, valves, piping and instruments as shown in plans and/or described in the specifications.

SECTION B: Construction of a water supply line from the pump house to a service storage tank.

SECTION C: Construction of a 50,000 gallon ground level, steel storage tank; at a location to give adequate water pressure.

SECTION A

1. DAM

a. It is estimated that all earth, stone or gravel required for construction of the dam will be obtainable at, or in the close vicinity of, the downstream portion of the reservoir.

Rock riprap: Approximately 980 C.Y. required.
Test holes show borrow pits will contain a variable amount of random stones of all sizes. Since all stones over 3" diameter must be combed or bladed from the fill before compacting a current lift, it is possible that the amount of this material accumulated at the upstream slope of the fill will be sufficient for the riprap requirement.

b. Site Preparation: The bed of the dam shall be cleared of all trees, brush or other vegetation and sod. Boulders shall be broken up and placed contiguous to the downstream toe of the fill. No trench or pipeline excavation under the dam shall be started until the bed of the dam has been cleared and

stripped of topsoil. Trees, brush and slashings shall be removed and disposed of by burning, or otherwise, outside the reservoir basin. If burned, the Contractor will be responsible for keeping the fire confined to the brush pile and all embers thoroughly extinguished. The volume of sod stripping or un-usable overburden from the bed of the dam and/or from borrow pits will be determined from measurements of area and depth and payment will be made therefor at the unit price bid per cubic yard for "common excavation", which is herein defined as that excavated earthen material which must be wasted. The price bid for this item shall include the work of clearing and grubbing trees and brush from the bed of the dam.

c. Pipe Lines Under Dam: These consist of a 12" cast iron line for reservoir control, a 6" cast iron line for pump supply from an infiltration gallery and a 3/8" O.D. copper tube for a static water level recording gauge to be furnished by the Owner. The control and supply lines shall be Class 150 cast iron pipe with mechanical bolted joints and compression gaskets. The gauge line shall be 3/8" O.D. copper tube, Type K, with flared compression fittings. The upstream 3" of the copper tube shall be drilled with 20 1/8" holes at about 1/4" C-C and this section wrapped with one turn of fine bronze or copper screen soldered to the tubing to prevent displacement when the line is backflushed. The end of the pipe shall be sealed. The downstream end shall be carried around the inside wall of the pump house on suitable brackets or clamps to the location of the instrument panel with a straight 1/4" bronze needle valve 12" ahead of the terminus. Care shall be taken in bending the tubing, and in backfilling, to ensure that the tubing is free from any kinks that would prevent free flow and the line shall be tested for flow after backfilling. All lines under the dam shall be installed and the pump house floor, external walls and roof completed before dam embankment is placed.

Pipe lines shall be laid on tightly compacted bed material and in the same trench as close together as the pipe bells will permit, except that downstream from the sheet piling diaphragm, where the lines spread to enter the pump house, the Contractor may, at his option, use separate ditches for the cast iron lines. From the diaphragm to the upstream cutoff collar the trench shall be excavated to firm, sound bedded material and the pipe laid thereon, as follows:

(1) The pipe shall be set on bricks or shims so that entire pipe weight is borne by the barrel and none by the bell or compression gland in order to relieve the joints of any pipe weight. There shall be a minimum 3/4" space between the pipe barrels and the bed material. After assembly, the lines shall be tested for leaks by water pressure of 100 psi maintained for 30 minutes. Stiff, lean concrete, having a slump of approximately 2" and a minimum compressive strength of 1500 psi at 28 days, shall be firmly tamped under and around the pipe barrels to the mid-diameter of each pipe. Concrete for this purpose shall have maximum 1/2" aggregate to promote good workability

under the pipe. This concrete bedding shall extend from the joint above the upstream concrete cutoff collar to the first joint below the downstream steel diaphragm. Where the pipe lines pass through the steel diaphragm they shall be sealed therein by concrete extending far enough from the lines to give a minimum 12" contact and bond on the surface of the steel sheeting. The 6" supply line shall have a minimum 5' cover between the dam and infiltration gallery.

(2) The 12" reservoir control line shall have a screened inlet as shown on Sheet 7 of the plans. The concrete shall have a minimum compressive strength of 2000 psi at 28 days. Concrete used in the cutoff collar shall have a compressive strength of 3500 psi at 28 days. Welded grating of other characteristics may be used provided the mesh opening is no larger, and the bar thickness and total area of openings is at least equal to that shown. The grate shall have two coats of a paint-like coating providing true galvanic protection, equal to "Zincilate", Spec. MIL-P-26915, as manufactured by Industrial Metal Protectives, Inc., 402 Homestead Ave., Dayton 8, Ohio.

(3) Pipe laid under the dam itself on material other than bedrock shall have adequate bell holes to relieve the joints of pipe weight. All pipe joints located between the upstream toe of the dam and the pump house shall be protected against future corrosion of the steel joint bolts by one of the following methods, at the option of the Contractor:

(a) The joints may be encased in a concrete jacket giving the bolts a minimum 1" of cover, or

(b) Each bolt to be given a coat of "Zincilate" or equal galvanic paint before assembly.

Then, after tightening and testing, each bolt and nut is to receive a heavy coat of galvanic paint and the entire joint wrapped with 6" paint-coated pipeline fabric, lapped over the top, to protect the coating during backfilling. Backfilling shall not be started until the paint has set up 24 hours or longer. Backfill to the full depth of the pipe trench shall be compacted by mechanical means to not less than the density of contiguous, undisturbed soil.

(4) The infiltration gallery line at the head of the 6" cast iron supply line shall be 120 lineal feet of standard weight, 12" perforated vitrified clay pipe, conforming to ASTM Designation C211-57T, or latest revision thereof, having six rows of 1/4" holes spaced approximately 3" center to center along the rows.

(5) The black earth overburden shall be stripped from the sand-and-gravel deposit at the infiltration gallery location for a width of at least 15 feet each side of the centerline. This material shall be stockpiled above high water level for later use by others. The perforated clay pipe shall be laid

with the perforations down and bedded in coarse gravel so that no weight rests on the pipe bells, with the bells pointed "up-grade". The spigot ends shall be truly centered in the bells and firmly seated against the shoulder of the sockets. The gravel cushion under the pipe, and the backfill material to a depth of 6" over the pipe, shall be minimum 3/4" size, either screened from the material in place at the site or crushed rock hauled for that purpose. If crushed rock is used, it shall be of a granitic or quartzose type, free from lime or any minerals soluble in water at 60° F. Backfill to a depth of 6' above the pipe and to the width of the stripped areas is to be made with the sand-and-gravel mixture, free from topsoil, in place at the site. The riser stack from the infiltration gallery shall be of standard 12" vitrified clay sewer pipe, non-perforated.

(6) The 12" cast iron control line will be measured by the lineal foot from its upstream end to the flanged joint at the upstream 12" valve and, payment will be made therefor at the unit price bid per lineal foot for this item, which shall include all materials and work of installing the 12" line. The 12' run of 12" pipe downstream from the 45° bend in the pump house is included in another item.

(7) The concrete cutoff collar and screened inlet box will be paid for at the lump sum amount bid, respectively, for these items.

(8) The 6" pump supply line will be measured by the lineal foot of pipe from its head, at the infiltration gallery, to the flanged joint inside the west wall of the pump house and payment will be made therefor at the unit price bid per lineal foot for this item, which shall include all materials and work of installing the same.

(9) The 3/8" O.D. copper gauge line will be measured by the lineal foot of such line installed in place, including specified fittings, and will be paid for at the unit price bid for this item.

(10) The 12" infiltration gallery line will be measured by the lineal foot of such pipe laid and shall include all material and work of installing the same, including backfill with specified material and the vertical stack at the north end of the gallery, and will be paid for at the unit price bid for this item. Stripping of black dirt above the line will be paid for as "common excavation".

d. Sheet Steel Piling: A water cutoff diaphragm of sheet steel piling shall be installed. The material shall be of No. 7 gage (approximately 3/16") corrugated, galvanized sheet steel, with interlocking joints as made by the Armco Metal Products Division.

Due to presence of small boulders and rock cobbles

in the pervious material overlaying bedrock this sheeting cannot be driven. It shall be installed in a trench excavated to bedrock, the trench having a minimum width of 48" to permit the operation of a mechanical tamper on both sides of the sheeting during the operation of trench backfilling. At the contact point with bedded schist a small notch of nominal 8" width and 12" depth shall be cut with an air chisel or similar means. This small notch shall be cleared of loose material and the steel sheeting set therein, each piece interlocked with the preceding piece. The notch shall then be filled with concrete having 3000 psi compressive strength in 28 days. The sheeting shall be kept vertical by temporary walers until the backfill has progressed to a stage where it is firmly held in this position by the backfilled material.

Backfill material shall be deposited in nominal 8" lifts, with finer material on the upstream side and coarser material on the downstream side, and be compacted to at least the density of the undisturbed wall material of the trench by mechanical tampers operating simultaneously on both sides of the sheeting; care being taken to keep the pressure on each side of the sheeting as nearly equal as practicable during this operation. Lengths of the various steel sheeting sections are at the option of the Contractor, except that no length of sheeting shall project more than 12' above the point where it is supported by embankment or trench backfill on both sides of the sheeting. At the horizontal joints joining successive vertical lifts of steel sheeting, below Elev. 63.0, the joints shall be made watertight in the following manner.

(1) Each sheet of piling shall be interlocked with the preceding section with its lower edge truly aligned with the sheet below, to which it is to be joined. It shall then be welded to the sheet below, with a one-pass bead of welding on the upstream side, using a general purpose, mild steel, fast-running, 1/8" electrode similar and equal to "Steelarc", as made by the All-State Welding Alloys, Inc., of White Plains, N. Y. The pass shall be made as rapidly as practicable, consistent with good welding practice, to minimize heat distortion of the sheeting and burning-off of its galvanized coating. While hot, the welded joint shall be cleaned of slag, weld spatter and burned zinc on both sides of the sheeting by vigorous wire-brushing and, while metal is still hot, the galvanized coating shall be restored on both sides of the sheet by application of a zinc-tin-lead alloy similar and equal to "Galcover Bar", as made by the All-State Welding Alloys, Inc., of White Plains, N. Y.; the tinning or plating action being accomplished by rubbing the bar over the still-hot metal, without flame; the plating action being facilitated by use of a clean wire brush in accordance with the manufacturer's recommendations. All welds on galvanized steel shall have the weld bead galvanized and burned-off zinc coating restored as described above.

e. Embankment:

(1) Earth: Material for embankment shall be placed in the fill with the densest and most impervious material at the center of the dam, graduating in degree of water-tightness to the outer slope, as shown on Sheet 5 of the plans. The material shall be placed in lifts of nominal 8" loose thickness. All stones larger than 3" shall be raked or "combed" out by scarifier or other means and removed before compacting the lift. Stones so removed may be left at the upstream edge of the fill to be used as riprap. The material shall, if required, be wetted to near optimum moisture content and compacted with a sheepsfoot roller. The roller for embankment compaction shall be equal to that required by the South Dakota Department of Highways for earthwork compaction; namely, one having teeth or studs not less than 6" long and a weight, when filled, adequate to transmit a pressure of not less than 550 pounds per square inch to the end surface of the studs.

Backfill shall be placed in lifts approximately 8" thick (loose measure) and rolled until the studs, with the roller in motion, do not penetrate more than about 1/4"; a degree of compaction ranging from 90 to 95 percent of maximum dry density, as measured by AASHTO Method T99-49. Compaction around pipes, cutoff collar, or steel sheeting in areas inaccessible to sheepsfoot roller shall be by mechanical means capable of obtaining the same degree of compaction.

The top of the dam shall be sodded with topsoil 8" thick, this material being compacted and considered as "embankment in place". The embankment shall be cambered so that the actual finished elevation of the top at any point will exceed the depth of fill below Elev. 4466 at that point by 2 1/2 percent, to guard against possible loss of freeboard by future settlement.

Embankment will be measured by cubic yard of finished embankment constructed and shall include excavating, hauling from pits in or adjacent to the reservoir and processing the material in place. Payment will be made therefor at the unit price bid per cubic yard for this item.

(2) Rock and Gravel Fill: The embankment on the downstream side of the water cutoff diaphragm shall be composed of coarse sand, gravel, stones, rock cobbles and boulders with no maximum size specified. The material shall be deposited in lifts conforming, as nearly as feasible, to the following procedure:

(a) A layer of boulders, rock cobbles and stone shall be deposited on the downstream side of the cutoff diaphragm with the larger pieces placed at the downstream toe or slope of the dam. No rock cobbles, or large stones shall be placed within 4" of the downstream face of the diaphragm, in order to preserve the galvanized coating of the steel sheeting from impact damage. The spaces between the large stones shall

be filled with gravel and/or sand hauled from borrow pits in the reservoir bed. This finer material shall be sluiced into the spaces between the larger stones by hydraulic means, using high-pressure hose lines for this purpose. Sluicing water, in the amount of $2\frac{1}{2}$ to 3 times the volume of the material placed, shall be used to effect compaction of the material so placed. Special care shall be taken in placing the fill under the site of the spillway to effect as high a degree of compaction as feasible, in order to minimize future settlement of embankment at this point.

f. Spillway: The spillway consists essentially of three parts: the forebay, the nappe and flume section, and the reaction bucket with its diffusion apron and wingwalls.

(1) The forebay is to be of the same type and weight of corrugated, galvanized, interlocking steel sheeting used for the water cutoff diaphragm in the dam and interlocked with the diaphragm sheeting. This shall be driven, with the bottom of the sheets to Elev. 4454, when the earth embankment at this point has reached approximately Elev. 4460. The forebay cutoff curtain of the same material may also be driven at this time. This is not to be interlocked with the sheets forming the sides of the forebay channel and is simply to prevent any undercutting of the concrete forebay slab. The slab shall contain grout pipe fittings, as shown in the plans, so that the slab may be readily "mud-jacked" back to design elevation to compensate for settlement of the earth embankment.

(2) The overfall nappe and flume portion of the spillway is to be of welded steel plate construction in three articulated sections, each section being fixed at the upper end and "floating" in the next lower section with a watertight slip joint, as shown in the plans, to accommodate some settlement of the stone-and-gravel embankment as well as thermal expansion and contraction of the steel. The bed shall be of $1/4$ " plate and the sides, of the $3/16$ " plate, stiffened and reinforced as shown in the plans. After assembly, any voids under the bottom plates shall be filled with sand hydraulicked into place, so that the bed of the flume rests solidly on the downstream slope of the dam.

The overfall nappe section shall be welded into the corrugated steel sheeting diaphragm of the dam, the $1/4$ " bed plate projecting 1" over the upstream limits of the corrugations. It will be necessary for a shallow trench to be left on the upstream side of the diaphragm to permit the welder to run this bead. Weld beads and burned-off galvanizing at the junction of the flume bed and sides with the cutoff diaphragm shall be re-galvanized on the upstream side, only, as described in the section "Sheet Steel Piling". The sidewalls of the flume shall be inside of the notch left, or cut, in the diaphragm to receive the nappe section and shall be smoothly shaped and welded into the notch with no projections to cause turbulence or snag floating debris.

The intermediate and lower flume sections shall have their upper ends anchored to concrete sills cast into the downstream face of the dam, with their lower ends "floating" in the succeeding downstream section so that, in case of excessive future settlement of the stone and gravel fill, the sections may be loosened, raised to compensate for such settlement and re-secured in place.

The steel flume sections shall be prefabricated in a shop equipped to do such work and closely checked for dimensional accuracy. They shall be shop coated as hereinafter described, hauled to the site and set with a crane, beginning with the downstream section, at the concrete bucket, and ending with the nappe section jointed to the cutoff diaphragm. The slotted holes to accommodate the slip joint bolts, in the downstream end of the nappe and intermediate sections, shall be shop-cut. The holes in the fixed-end sidewalls of the receiving section shall be field-drilled to fit the position of the slotted holes after the two sections are in place. The slotted holes for the slip joint at the junction of the steel flume with the concrete bucket shall be field-cut to match the position of the bolts set in the walls and bed of the concrete bucket.

The lap area of the slip joints shall have both movable and fixed surfaces pre-coated with Neoprene-Hypalon, a liquid synthetic rubber coating, as manufactured by E. I. DuPont de Nemours & Co. and merchandised by the Surface Engineering Co., Inc., Wichita 1, Kansas. A sufficient number of coats shall be applied to the thoroughly cleaned contact surfaces to give a coating approximately $3/32$ " thick on each. When the sections are to be joined, the fixed contact surfaces shall be given one more heavy coat and the surfaces pressed together.

A beam shall be placed across the top of the fixed downhill section and pressure applied to the free end of the floating uphill section by jacks or other means, until the liquid neoprene is extruded from the joint in the bed of the flume. While the pressure is maintained by the jacks, the locking scab plate (see Expansion Joint Detail S-J-1, plans) shall be pressed tightly down on the lap strip and welded to the vertical leg of the bed-plate stiffer angle of the fixed (downhill) section. Care shall be taken not to carry the weld down the vertical leg of the angle far enough to burn off the protective coating of the bed plate. With the pressure maintained, the holes for the slip joint bolts shall be field-drilled in the sidewalls of the fixed section to match the slotted holes which were shop-cut in the floating end of the uphill section.

Each of the flume sections shall be coated after all shop fabrication is completed with a material giving the metal true galvanic protection. It shall be similar and equal to "Zincilate" as made by Industrial Metal Protectives, 402 Homestead Ave., Dayton 8, Ohio, and marketed by Cook Paint & Varnish Co. stores. The coating material shall conform to Spec. MIL-P-26915 and approved by USAF as an alternate to

hot dip galvanizing, ASTM Designation A-123. The under side of the flume bottom and both sides of the 6" channels at the anchor walls shall be given four coats of 2 mil thickness each; the sidewalls, inside and outside, and the inside bed of the flume, including all structural steel bracing, to have two coats of 2 mil thickness each. Preparation of the steel and application of the material shall be in strict accordance with manufacturer's recommendations.

Care shall be used in transporting and handling the sections to avoid injury to the coating. Before placing each section it shall be checked for damage to the coating and if such has occurred, it shall be repaired by a field application of the coating.

(3) The spillway bucket, with its diffusion apron, sidewalls, wings and curtain wall, shall be of reinforced concrete construction, the concrete for which shall have a compressive strength of at least 4000 psi in 28 days. The cyclopean concrete reaction block shall be composed of large clean stones or boulders firmly bedded and entirely surrounded by concrete having a compressive strength of at least 3000 psi in 28 days.

Concrete for the walls and floor shall have a slump not to exceed 3" and shall be agitated during placement with a mechanical vibrator of adequate size. Concrete walls exposed to view shall be free from laitance, spalls, cat-faces, form marks or other blemishes. If such blemishes occur they shall be pointed up with mortar, using a latex concrete, epoxy compound or other bonding agent approved by the Engineer, or by stoning. This shall be done immediately after removing the forms. The exposed corners shall be chamfered not less than 1/4" or more than 3/4".

The floor slab shall be placed in one continuous pour from the downstream curtain wall to the upper end of the cyclopean concrete reaction block and shall be given a good float finish, free from laitance.

The concrete shall be cured by moist-curing for 7 days after placement or by a colorless concrete curing compound approved by the Engineer. If used on the floor slab, it shall be applied within two hours after the concrete has taken a preliminary set. If used on the walls, it shall be applied immediately after the forms have been removed and the blemishes, if any, remedied.

G. Riprap: The upstream face of the dam shall be riprapped, from the toe of the embankment to top of dam with rock placed on a 2" blanket of gravel; the combined thickness of rock and gravel to be not less than 9". The gradation of the rock shall be such that the spaces between the larger stones is well filled with smaller fragments.

Riprap will be paid for at the unit price per cubic yard bid for this item in place, computed on the basis of a layer 9" thick covering the measured surface area.

h. Seeding: The top of the dam shall be seeded with crested wheat grass, Fairway Strain (*Agropyron Cristatum*), drilled in at the rate of 20 pounds of live grass seed per acre. The seed bags or containers shall carry a vendor's tag or label setting forth the type of grass, percent of germination and percentage of foreign material for the seed furnished; or, the Contractor shall furnish a certified statement from the vendor attesting to the above characteristics of the seed furnished. The seeding shall be done in conformity with accepted good agricultural practice with regard to season, moisture in the soil and seeding equipment. This portion of the work will be performed by the Owner.

2. PUMP HOUSE

a. Structural: Concrete used in construction of the pump house shall have a minimum compressive strength in 28 days as follows:

Floor slab: 3,000 pounds per square inch

Roof slab: 3,500 pounds per square inch

Reinforcing bars shall be free of oil, grease or heavy rust, properly bent and placed as shown in the plans and care shall be taken to insure that the steel is not moved from its design position during placement of concrete. When placing concrete it shall be thoroughly agitated or spudded, preferably with a mechanical vibrator, to release entrapped air and increase its density and bond on reinforcing steel.

Roof scffit block shall be thoroughly wetted immediately prior to placing the concrete.

Exposed concrete shall be moist-cured for not less than 7 days after placement by covering with burlap or moist earth and sprinkling, or by spraying it, after initial set, with a colorless concrete curing compound approved by the Engineer.

Centering or support framing shall not be removed from under the roof slab until it has been properly cured for at least 15 days, and no load should be placed on the roof until after 28 days. The top of the roof slab shall be crowned 1/2" across the 14-foot dimension by thickening the cover concrete at the center. The inner surface of the roof deck shall not be crowned, but remain level.

Masonry block shall be laid up with each course solidly bedded in mortar with vertical joints breaking half way between

those of the preceding course and mortared the entire height of the masonry unit, using mortar made from one part commercial masonry cement and not more than 2-3/4 parts clean sharp sand. All exposed joints shall be tooled. The masonry walls shall be kept clean of mortar spatter as the work progresses.

Non-mechanical ventilators shall be of the grille-and-damper type with inside control of the damper from "open" to "closed" position. It shall be of the type to lay up in the wall and occupy the space of one masonry block or two glass block.

The doorway of the chlorinator room shall have a door-sill embodying an extruded plastic type of weatherstop. The sides and top of the door frame shall have a cemented-on type of sponge rubber weatherstrip. All openings made in the partition wall between the chlorinator room and pump room, for wiring or piping, shall be sealed with gray mastic caulking compound before painting.

Electrical power: 110 and 220 volts, 3-phase, 60-cycle, Power will be delivered to the pump house by the utility company. All other electrical equipment and material shall be furnished and installed by the Contractor. All electrical wiring shall be in conduit and shall conform to the National Electrical Code. Power leads shall have outside lightning arresters equal to Westinghouse 825-552.

The outside walls below grade shall have a heavy coat of Foundation Coating #833 as sold by Dakota Lime and Brick Co. Exposed outside walls: One coat Cook's "Cling Block Filler" plus one coat Cook's "A-KRYL-X" acrylic latex paint, or equal, white. Roof: Two coats "A-KRYL-X", white. Interior walls: Two coats Cook's "Corovel", or equal, cream color. Floor: Two coats Cook's "Cling Cement Floor Coat", or equal, gray.

Payment for the pump house structure shown in plans and/or described under paragraph 2, subparagraph a., Section A, above, entitled "Structural", will be made in the lump sum amount bid for this item.

b. Pumps: Two pumps shall be installed, each having a capacity of 120 GPM at 330 feet TDH. They shall be of the horizontal, direct-drive, flex-coupled type, having a non-rigid drive shaft connection between the motor and the impeller section. The plans show a type of pump having an end-suction and side-bottom discharge flow pattern. Bidders proposing pumps with different flow patterns, such as an opposed suction-discharge arrangement, shall submit a drawing of their proposed piping diagram for such pumps from the metered pump supply line to the common junction with the 6" supply line to the storage tank. Such alternate piping arrangement shall have a friction loss no greater than that shown in the plans.

The pumps will be given a pumping test after installation. The test shall be performed by the Contractor under supervision of the Engineer. Services of the pump manufacturer's representative shall be made available, without cost to the Owner, to insure that the pumps are installed and functioning properly. An operation and maintenance manual and parts list for the pumps installed shall be furnished the Owner without charge.

Bidders shall submit full informative data on the pumps they propose to furnish, including performance curves, horsepower requirements and installation dimensions. The pumps will have a positive head on the suction side ranging from 0.5 feet to 20 feet, according to level of water in the reservoir.

c. Pump Controls: Motor starters for the pumps shall be across-the-line type equal to Allen-Bradley Bulletin 712 Series, fused, with overload and low voltage protection; these starters to be actuated by the controls described hereinafter. The storage tank water level control transmitter shall be a Healy-Ruff "Rototrol", Type C, with adjustable time delay on "Start" and "Stop", as manufactured by the Healy-Ruff Co., 2255 University Ave., St. Paul 14, Minnesota, or equal, approved by the Engineer. This is to be actuated by a 3/8" copper line to carry static water pressure from the tank. It shall be for a static head range of 300 to 330 feet of water. The automatic alternator shall be a Healy-Ruff "Altitrol" for two pumps. There shall be a 1-to-2 minute time delay device in the circuit to Pump No. 2, equal to Allen-Bradley Bulletin 849, ZAA Series. All the above to be in Nema I enclosures. Equal equipment of other manufacturers may be used if approved by the Engineer after a submission of full descriptive literature and specifications.

A three-station selector shall be provided, with the stations designated "Pump 1", "Pump 2", and "Alt. Bypass", each with "OFF-HAND-AUTO". The performance characteristics of the control circuiting shall be such that the following pumping programs may be selected at the option of the operator:

(1) Program 1: Upon "Start" signal from transmitter to receiver, one pump will operate until shut off by a "Stop" signal; the sequence of operating being automatically alternated between the two pumps.

(2) Program 2: Upon "Start" signal from transmitter to receiver, both pumps will operate until shut off by a "Stop" signal, with Pump No. 2 starting approximately one minute later than Pump No. 1.

(3) Program 3: Either pump may be started or stopped or removed from automatic control manually for the purpose of testing or repair. An "as built" wiring diagram of pump control circuits shall be furnished the Owner without charge.

Payment for "pumps in place" shall include furnishing, installing and testing the equipment shown in the plans and/or described under paragraph 2, subparagraphs b and c, Section A, above,

d. Meters:

(1) Meters shall be installed in the 4" auxiliary reservoir control line for the release of small flows from the reservoir and in the 4" line ahead of the pumps. They shall be 4" flanged "Sparling Tube Meters", No. 245, or equal, approved by the Engineer. Each shall have an Indicator-Totalizer dial indicating the rate of flow in gallons per minute and the total flow in units of 1,000 gallons. Flanged tube meters will be paid for at the unit price, each, bid for this item, installed in place.

(2) Control Valve and Screen: The 4" auxiliary control line shall have installed, where shown, a Y-pattern sediment separator to protect the meter, the separator being Crane No. 989 $\frac{1}{2}$, or equal, approved by the Engineer. It shall be installed immediately downstream from the regulating valve which shall be a rubber-faced, eccentric-plug type valve, gear operated to hold any desired setting, equal to "DeZurick" No. 101FWG, capable of passing sediment-laden water at any degree of closure without undue wear on seat or plug.

e. Chlorinator: The chlorinator shall be Wallace & Tiernan, Series A-741, wall-mounted, gas feed type, with 10# per day rotameter, injector, water pressure gauge and a full set of operation and maintenance instructions. The point of chlorine application shall be in the pump supply line ahead of the pump suction, which shall be tapped to receive the feed fitting. A 3/4" tap shall be made in the 6" supply line leading to the storage tank and a 3/4" copper tube line run from this point to serve a hose bibb on the pumphouse wall where shown and a water supply to the chlorinator. Chlorinator equipment shall include all necessary solution tubing, valves, cocks or other fittings required to make proper installation of the equipment. Installation and testing of the equipment shall be done under the supervision of the manufacturer's representative. A compact platform scale of 1,000-pound capacity and a chlorine testing kit, with comparator scale and supply of orthotolidine, shall be furnished as accessory equipment. The chlorinator control shall be wired to start the chlorinator when either or both pumps are started and stopped at the end of the pumping cycle. Setting of the chlorine feed rate to be done manually, according to the pumping program selected by the operator. A motor-driven exhaust fan ventilator, with a minimum air capacity of 500 CFM, equal to Pryne #2206, shall be installed in the chlorinator room and wired in circuit with the light switch for the chlorinator room which shall be located outside the room. The fan shall be installed at floor level to draw air from floor

level and discharge through a swinging-dampered duct in the west wall of the building.

Payment for the chlorinator shall include furnishing, installing and testing, complete in place and ready for use, the equipment outlined in paragraph 2, subparagraph e, Section A, above,

f. Heaters: Heaters shall be of the electric, blower type and capacity shown in the plans and equipped with thermostatic control. Equal heaters of other manufacture than that shown may be used, if approved by the Engineer.

g. Valves and Piping: Valves in the pump supply and reservoir control lines, other than the 4" regulating valve, shall be iron body, bronze mounted, double disc gate valves with non-rising stems, faced and drilled 125-pound standard. All gate valves and check valves in the discharge lines from the pumps, or subject to hydrostatic pressure from the storage tank supply line, shall be designed, faced and drilled 250-pound standard. The check valves shall be iron body, bronze mounted, swing-gate type, with removable top plate and flow direction arrow cast or stamped thereon. All valves shall have their WOG operating pressure rating cast or stamped in the body of the valve. Gate valves shall be so constructed that they may be repacked, when wide open, under full rated pressure.

All cast iron pipe used in the reservoir control or pump supply line shall be Class 150; all cast iron pipe used in the 6" supply line to the storage tank shall be Class 200. Exposed piping, smaller than 12", inside the pumphouse may be cast iron or galvanized steel pipe, at the Contractor's option. Cast iron pipes passing through rigid walls shall either

(1) Have a bolted mechanical joint within two feet of the external wall, or

(2) The length of pipe rigidly fixed in the wall shall be bedded in concrete from the wall to the first mechanical joint, as specified for a portion of the pipe lines under the dam.

All exposed valves and piping in the pumphouse, other than copper tube, shall be painted with two coats of good metal paint approved by the Engineer; low pressure lines, green, and high pressure lines, red.

The item "Miscellaneous Pump House Valves, Piping and Equipment" shall include furnishing and installing of all valves, piping, fittings and other equipment shown on Sheet 11 of the plans and/or described under paragraph 2, subparagraph d2, f and g, Section A, above, and also the discharge section of 12" cast iron reservoir control line terminating in the spillway tailrace 12' from the downstream flange of the 45°

bend shown. Payment for this "Miscellaneous" item will be made in the lump sum amount bid for the item.

SECTION E

1. WATER SUPPLY PIPELINE

a. Cast iron pipe and fittings shall conform to Federal Specification WW-P-421 or A.S.A. Specification A21.8. Asbestos-cement pipe shall conform to Federal Specification SS-P-351 or AWWA Specification C-400-53T. Copper tube, for the static water pressure gauge line, shall be Type K, conforming to ASTM Designation B88, for underground service.

b. Gate valves shall be iron body, double disc, bronze or bronze-mounted, non-rising stem, double hub type except that auxiliary gate valves installed at fire hydrants shall have one flanged and one hub end. Gate valves shall open by turning in a counterclockwise direction and shall be so marked with an arrow cast on the operating nut. All valves shall be designed for a working pressure of not less than that of the line where installed, and shall have a pressure rating, maker's initials, and year of manufacture cast upon the body.

Each gate valve shall be equipped with a cast iron valve box having a barrel of not less than 5" inside diameter. The box shall have a screwed sleeve or top section so that the length of the barrel may be adjusted to bring the top to the proper grade. It shall be equipped with a loose cast iron cover marked "WATER".

c. Construction Methods:

(1) Excavation and Trenching: The ground shall be excavated in open trench to the width, depth and alignment necessary for the proper construction of the water main except where tunneling is considered necessary or proper by the Engineer and approved by him in writing.

If, through neglect of the Contractor to adequately shore a trench or properly unwater it, the bottom of the trench becomes an unstable foundation for the pipe, in the opinion of the Engineer, the Contractor shall remove such unstable material and replace it with compacted gravel at his own expense.

However, if the undisturbed material encountered at grade depth constitutes an unstable foundation for the pipe, in the opinion of the Engineer, he may require the removal of such unstable material and replacement of the same by compacted gravel. Compensation will be paid to the Contractor at the cost-plus rate bid for performing "Extra Work".

If ledge rock is encountered in the excavation, it shall be removed to a level 6" below the grade of the pipe. The Contractor shall not remove the rock until its elevation or profile has been recorded by the Engineer. A 6" cushion of compacted earth shall be placed over the rock before any pipe is laid on it. If the rock is removed by blasting, proper safeguards shall be employed to prevent injury to persons or property and the blasting shall be done only by one experienced in such work. Compensation will be paid to the Contractor for such ledge rock excavation at the bid price for this item.

Ledge rock is defined as solid rock formations or dislodged boulders of not less than 16 cubic feet in volume. Shale, cemented gravel, or similar formations shall not qualify as "ledge rock" even though mechanical breakers or explosives may be required for their removal. Measurement by the Engineer shall be made of the profiles or volumes of the rock as it is removed, but no measurement shall be allowed for ledge rock less than 6" in thickness.

Hard-pan, stiff clay, compacted sand, and similar materials, normally considered by the trade as "difficult digging", shall not qualify for extra payment, nor shall quicksand or the presence of strong flows of ground water, these difficulties being considered to be the normal hazards incidental to the business.

Where directed by the Engineer, the sides of the trenches shall be shored in an approved manner with wood sheeting not less than 2" thick, or with steel sheeting of equal strength.

The Contractor will be responsible for any injury to persons or property resulting from failure to adequately shore any trench, whether or not the placing of such shoring was directed by the Engineer.

During excavation of the trenches, the Contractor shall exercise due care to preserve all stakes set by the Engineer and to avoid all injury to such gas, water, sanitary, electrical or communications utilities as may be encountered in the course of the work. Any damage done to such utilities by the Contractor shall be promptly repaired by him at his own expense. Construction stakes destroyed by the Contractor will be replaced by the Engineer at the Contractor's expense.

Trench excavation shall be carried to sufficient depth to provide an earth cover of not less than 6' above the

top of the pipe.

Bell holes shall be adequate to allow for good workmanship in making up the joints.

(2) Pipe Laying: The interior of all the pipes and fittings shall be thoroughly cleaned of all foreign matter before being lowered into the trench, and due precautions shall be taken to prevent the entrance of ditch water into the pipe or fittings. Pipe shall not be dropped into the trench from the bank above, but shall be lowered in a manner to prevent injury to the pipe.

Deflections from a straight line due to vertical or horizontal curves or offsets shall not exceed, for any one joint, the maximum recommended by the manufacturer of the type of pipe being laid.

If the alignment requires a deflection in excess of that given above, the Contractor will either provide a special bend or a sufficient number of shorter length of pipe so that the deflection at any joint shall not exceed the specified maximum.

All bends of $22\frac{1}{2}^{\circ}$ or more shall be anchored by concrete thrust blocks. Concrete thrust blocks shall bear squarely against the firm, undisturbed soil of the side of the trench. The minimum thrust bearing area of the blocks shall be equal to six times the cross-sectional area of the pipe, in the case of 90° bends and tees, and four times the cross-sectional area of the pipe in the case of 45° or flatter bends.

Mechanical joints shall be coupled and secured in strict accordance with the manufacturer's recommendation and in a manner that will insure a permanent and watertight seal.

All cast iron pipe shall be laid on a firm, full bedding for the length of the barrel.

Cement-asbestos pipe shall be laid, in the properly graded trench, supported at the support points marked on the pipe approximately $\frac{1}{5}$ the length of the pipe from each end. Immediately after coupling and aligning the pipe, the space under the pipe barrel and up to the horizontal axis of the pipe shall be backfilled and thoroughly tamped to form a firm and uniform bed for the pipe. Installation shall be strictly in accordance with the manufacturer's installation manual, with special care given to proper bedding of the pipe.

(3) Valves and Valve Boxes: The valves shall be thoroughly inspected and cleaned before installing. The valve shall be installed with the operating nut in a truly vertical position. The valve box shall be set plumb and centered over the operation nut and shall be kept in that position during

backfilling. If the valve box is off center after backfilling so as to cause any binding of the valve operating wrench, the assembly shall be taken up and properly installed at the Contractor's expense.

(4) Tests: All joints in pipe lines shall remain uncovered until the line has been subjected to a pressure test and found acceptable. Lines, including copper gauge line, will be tested in increments of 600' and 800', where feasible. The line to be tested shall be subjected to a water pressure of 150 pounds per square inch for Class 150 pipe and 200 pounds per square inch for Class 200 lines, and the pressure maintained for one hour by pumping measured amounts of water into the line. The leakage rate shall not exceed 80 gallons per inch of pipe diameter per mile of length per 24 hours. Any pipe, fittings or valves found to be defective shall be removed and replaced with sound units.

(5) Backfilling: When starting the backfill due care shall be taken to insure that each pipe is solidly bedded for its full length so it will not be subjected to beam action by settlement of the backfill. No large stones or boulders shall be placed within 3" of the pipe. The backfill may be consolidated by application of water, but flooding or puddling of the backfill will not be allowed unless, in the opinion of the Engineer, the soil surrounding the pipe is sufficiently porous or gravelly to permit such procedure without rendering it unstable. Special care shall be taken to bed and backfill the copper gauge line in such manner that it will not be kinked in a manner to impede free flow. All stones 4" or larger removed from the trench during excavation shall be replaced in the backfill below the ground surface. Any such stones remaining on the surface after the backfill is completed shall be disposed of as directed by the Engineer. The backfill of all trenches shall be finished by smoothly mounding the surplus material over the trench and rolling it down to cause a minimum of inconvenience to traffic.

(6) Pipe Line to Tank Site #2: This will involve much ledge rock excavation in the upper portion of the line, some of which is difficult of access. The rock waste will not be suitable for backfill over the pipe and earth shall be hauled for cushioning the pipe and for backfill. After the pipe has been covered with earth to specified depth the waste rock from the rock excavation shall be spread back over the backfilled trench to prevent erosion of the earth backfill, which shall be included in the price bid for earth hauled and placed.

(7) Miscellaneous: All surplus earth or stone removed during excavation shall be disposed of as directed by the Engineer. Materials and equipment used in construction shall be neatly piled or stored in such location and manner as not to impede vehicular traffic as far as practicable; and the work of construction shall be conducted in such a manner as to

minimize inconvenience to such traffic. The Contractor will take all proper measures, such as the use of barricades, flares, warning signs or flags to safeguard public travel on or about the project.

d. Measurement and Payment:

(1) Pipe lines shall be measured for payment as the actual survey length for each size and class of pipe actually laid during construction and accepted by the Engineer. Bends, tees or other fittings will be included and considered as "lineal feet of pipe".

(2) Gate valves shall be measured as units of each size, actually installed and including the valve and valve box complete in place and accepted by the Engineer.

(3) Ledge rock excavation shall be measured as the net volume between the upper and lower profiles of the stratum or between the upper profile of the rock formation and a line 6" below the pipe invert, and a maximum width of the external diameter of the pipe barrel plus 20", or minimum of 30", whichever is larger.

(4) Earth backfill, hauled and placed shall be measured as the actual cubic yards of compacted earth in place which has been hauled and placed in lieu of unsatisfactory excavated material.

(5) Payment shall be made at the unit price bid for the several items listed in the proposal for the quantity actually used in the accepted work. Such payment shall constitute full compensation for furnishing all materials, equipment and tools; for furnishing all labor; for performing all the work; and for incidentals necessary to complete the project complete in place and ready for use in conformity with the plans and specifications.

SECTION C

1. 50,000 GALLON STEEL STORAGE TANK

a. Ground Level Steel Tank at Tank Site No. 2:

(1) Details showing the desired dimensions and other details of this tank are shown on Sheet 7 of the plans. Dimensions shown may be altered slightly to fit the maker's fabrication technique, if desired, after approval of such alteration by the Engineer. The site shall be leveled by blasting and/or pneumatic tools to a comparatively true surface and a 6" compacted oiled sand cushion laid down to support the tank bottom. The sand cushion shall extend at least 8" outside the bottom stiffener angle and the edges of the cushion shall be protected from wash by rubble concrete around the outer edge.

(2) After notice of award of contract, and before construction is begun, the successful bidder shall submit to the Engineer two sets of detailed construction drawings of the reservoir, one of which will be returned after review and approval by the Engineer.

(3) The general design, the design loadings, allowable stresses, weld design and welding practice, shop fabrication and field erection practices and all materials used in the construction shall be in accordance with the latest "Standard Specifications for Elevated Steel Water Tanks, Standpipes and Reservoirs" of the American Waterworks Association.

(4) Pipe connections for one 8" cast iron pipe shall be provided, welded or brazed in place, in the bottom plates. It shall be of the gland, or compression ring, type.

(5) An outside vertical ladder shall be provided, designed to support at least 600 pounds at any one point. The ladder shall have no backward slope at any point unless a safety cage is provided. A roof ladder shall be installed to facilitate inspection and/or repainting of the roof. It shall provide access from the outside vertical ladder to the center of the roof and shall be rotatable completely about the roof. It may rotate about an ornamental roof finial or a gudgeon pin provided for that purpose. The roof shall be entirely self-supporting.

(6) A hinged roof hatch shall be provided above the high water line and within reach of the outside ladder. It shall have a clear opening of not less than 20" with a curb around the same. The cover shall overlap and extend down over the outside of the curb not less than 1½" and shall be fitted with a suitable hasp for padlocking.

(7) A 4" screened overflow pipe shall be provided. The screen shall be bronze or copper, soldered to the down-turned

elbow.

(6) Welding:

(a) Welds in the bottom plates may be lap or butt welds. If butt welds, the inside edges of the plates shall be beveled and a sufficient number of passes made to build the weld bead to full size. Each pass shall be cleaned by wire brushing or chipping to live metal before making a succeeding pass.

(b) Seams in the shell plates shall be butt welded on both sides. On vertical seams the reverse side of the initial bead shall be wire brushed or chipped to expose live metal of the initial bead before depositing the opposite bead.

(9) Painting:

(a) After the bottom welding is completed, the welds shall be cleaned and tested for leaks with soap solution and a vacuum plate. After completing the bottom pipe connection and at least one course of shell plates to give weight to the outer rim, the underside of the tank bottom shall be sealed by forcing a bituminous base caulking mastic into the 1/2" pipe connection, provided in the center of the bottom for that purpose, until the mastic shows at the 1/4" telltale holes in the periphery of the bottom stiffener angle. As the mastic shows at these holes they shall be plugged with 1/4" pipe plugs until sealing is complete.

(b) All rust, dirt, oil, grease, welding scale or loose mill scale or shop coat paint shall be removed from steel surfaces by wire brushing or chipping before any paint is applied.

(c) The underside of the bottom plates shall be given a cold-applied coating of coal tar pitch varnish before laying on grade. They shall be laid on grade and welded in place with as little handling as possible to avoid damage to the varnish coating.

(d) The inside of the reservoir bottom, shell, roof (and roof framing, if any) shall be painted one prime coat of A.W.W.A. Specification red lead, linseed oil paint or zinc chromate oxide primer, or equal, and one finish coat of A.W.W.A. Specification red lead, linseed oil paint or Inertol No. 55 interior tank coating, or equal.

(e) The outside of the reservoir shell, roof and external accessories shall be painted one prime coat of A.W.W.A. Specification red lead, linseed oil paint or zinc oxide primer, or equal, and two finish coats of aluminum paint containing two pounds of aluminum-pigment powder and paste per gallon of aluminum mixing vehicle.

(f) All ingredients of the above paints shall conform to the latest A.S.T.M. Specifications. All paints and mixing ingredients shall be delivered to the reservoir site in sealed containers which shall be clearly labeled with the manufacturer's name and the type of paint each contains. Paints shall be applied strictly in accordance with the manufacturer's instructions.

(g) Paint may be applied by brush or pneumatic spray gun. If sprayed, it shall be brushed out and worked into all crevices and corners, where necessary, to obtain a finish equal to first-class brush painting. No paint shall be applied when the metal is wet, or too hot or too cold to obtain a first-class job. Sufficient time shall be allowed for each coat to dry before a succeeding coat is applied. The finished appearance shall be free from cracks, runs, blisters, crazing or other defects.

(10) Testing:

(a) After construction and painting of the reservoir is completed, it shall be filled to the high water line. Any leaks that are disclosed shall be repaired by the Contractor. No repair shall be made on any shell joint unless the water in the reservoir is at least 2' below the point being repaired.

(b) Upon completion of work the Contractor shall remove or dispose of all rubbish caused by, or incidental to, his operation.

(11) Payment: Payment for the 50,000 gallon tank, with appurtenances described above, will be made as follows: Fifty percent (50%) of the bid price will be paid to the Contractor upon delivery of the steel to the site and the balance on completion of the work. The Contractor shall furnish the Engineer with the necessary invoices, etc., to properly document his claims for the first payment.

(12) Sterilization of Reservoir: The Owner will furnish water and chemicals to sterilize the above reservoir with a chlorine solution of 50 p.p.m. of available chlorine, retained in the reservoir for at least 12 hours. Water used for testing, above, may be utilized for sterilization, chemicals for which shall be provided by the Owner. Upon emptying the tank, the solution shall be held in the supply pipe line for a minimum 12 hours and emptied slowly into the reservoir via the pump supply line and infiltration gallery.

SCHEDULE OF BID ITEMS
BLACK HILLS BILTMORE WATER SUPPLY SYSTEM

Page 1

ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	
				WRITTEN PRICE	FIGURE
	SECTION A: DAM & ACCESSORIES				
1.	Common excavation	5,100	C.Y.		
2.	Pipelines at dam site				
	a. 12" C.I. pipe, Cl. 150	128	L.F.		
	b. 6" C.I. pipe, Cl. 150	144	L.F.		
	c. 6" C.I. pipe, Cl. 200, pump house to Cor. #5	560	L.F.		
	d. 12" perforated V.C. pipe	120	L.F.		
	e. 3/8" copper tube, Type K	708	L.F.		
	f. Concrete cutoff collar	1	Only		
	g. Inlet box and grating	1	Only		
3.	a. Trench & backfill, min. 48" for piling	650	L.F.		
	b. Piling notch, 8"x12", incl. concrete backfill	650	L.F.		
	c. Galv. sheet steel pile				
	(1) 7 gauge, in place	1,900	S.F.		
	(2) 12 gauge, in place	10,600	S.F.		
4.	a. Rolled earth embankment, in place	21,300	C.Y.		
	b. Compacted rock & gravel embankment, in place	2,600	C.Y.		
	c. Rock & gravel riprap, 9" thick, in place	980	C.Y.		
5.	Spillway, complete in place, including forebay slab, curtain wall & forebay wings		L.S.		

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ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	
				WRITTEN PRICE	FIGURES
6.	a. Pump house, structure		L.S.		
	b. Pumps, pump controls & switchgear, in place		L.S.		
	c. Chlorinator, in place		L.S.		
	d. Flanged tube meters, 4", in place	2	Each		
	e. Misc. pump house piping, valves & equipment, in place		L.S.		
7.	Parshall flumes	2	Each		
	SUBTOTAL, SECTION A				

ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	
				WRITTEN PRICE	FIGURE
	SECTION B: SUPPLY PIPELINE FROM CORNER NO. 5 TO TANK SITE NO. 2				
1.	a. Cast iron pipe, 6" Class 200, M-J	1,160	L.F.		
	b. Asbestos-cement pipe, 6", Class 200	780	L.F.		
	c. Cast iron pipe, 6" Class 150, M-J	144	L.F.		
	d. Asbestos-cement pipe, 6", Class 150	1,313	L.F.		
	e. Cast iron pipe, 8" Class 150, M-J	416	L.F.		
	f. Asbestos-cement pipe, 8", Class 150	429	L.F.		
	g. Cast iron pipe, 4" Class 150, M-J	16	L.F.		
	h. Copper tube, Type K, 3/8" O.D.	3,400	L.F.		
2.	a. 4" gate valve with C.I. valve box	1	Each		
	b. 6" gate valve with C.I. valve box	1	Each		
	c. 8" gate valve with C.I. valve box	1	Each		
3.	a. Ledge rock excavation, trench	284	C.Y.		
	b. Earth backfill, hauled and placed	224	C.Y.		
	SUBTOTAL, SECTION B				

ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	
				WRITTEN PRICE	FIGURES
	SECTION C: 50,000 GALLON STORAGE TANK				
1.	a. Rock excavation (site leveling)	18	C.Y.		
	b. Oiled sand cushion, average 6", in place		L.S.		
	c. 50,000-gallon, steel tank, complete in place		L.S.		
	SUBTOTAL, SECTION C				

SUBTOTAL, SECTION A.....\$

SUBTOTAL, SECTION B.....\$

SUBTOTAL, SECTION C.....\$

TOTAL, ALL SECTIONS.....\$

BIDDER: _____

BY: _____

ADDRESS: _____

REPORT OF A MEETING
HELD IN STOCKGROWERS COMMUNITY ROOM
RAPID CITY, SOUTH DAKOTA
SEPTEMBER 28, 1961

A committee representing stockgrowers on Battle Creek together with representatives of Dakota West, Incorporated met with J. W. Grimes, Executive Officer of the State Water Resources Commission and Raymond F. Lund, also from the Commission. Those present included the following:

Charles Phelps, Hermosa
Francis Brophy, Hermosa
Walter O'Neill, Hermosa
John T. Colgan, Hermosa
Charles Brophy, Hermosa
Terril Brophy, Hermosa
Ed Anderson, Rapid City
J. R. Anderson, Platte
Ed Wergin, Rapid City
V. L. Rugg, Rapid City
J. W. Grimes, Water Resources Commission, Pierre
Raymond F. Lund, Water Resources Commission, Pierre

John T. Colgan of Hermosa served as chairman of this informal meeting, which was held for the purpose of arriving at a better understanding of the relationships between Dakota West, Incorporated and the ranchers living on Battle Creek, with respect to a water permit which had been previously granted to Dakota West, Incorporated for a limited amount of water to be stored for their use.

In opening the discussion, Mr. Colgan referred to a meeting that had been previously held in Ed Wergin's offices in Rapid City, and to a later meeting held in Rapid City on Monday, September 8th, at which time a group of interested parties directed questions to Raymond Lund, who had been asked for such a meeting.

With this brief background, Mr. Grimes was then asked to explain the water permit which had been granted to Dakota West, Incorporated, a corporation which has planned a development project on Iron Creek.

In referring to a file copy of the permit which had been granted, Mr. Grimes read the restrictions which placed certain limitations on Dakota West, Incorporated water right. For example, only the unappropriated water could be stored. Although some of this unappropriated water could be stored in a reservoir, under the physical and climatic situation which prevailed in the area, it would be only the snow melt water available for storage such as contemplated by Dakota West, Incorporated. There are other times when water might be stored, but only at the time of high flows - high flows might be defined as the time that the flow from Battle Creek reaches the Cheyenne River.

Again, emphasis was placed on the fact that only the unappropriated water could be diverted or stored for use. At any stage of the reservoir, passage of water is provided. It was noted that Dakota West, Incorporated proposes to install a 12" diameter tube in the reservoir to allow for passage of water.

Reference was made to evaporation losses that occur. In view of the small reservoir involved here, apparently evaporation would not amount to much. The evaporation might be considered as an offset to loss that would otherwise occur in the creeks. Excess waters downstream would represent unappropriated water.

It was further pointed out that certain conditions had been imposed on the use of water from the dam. Water at the point of use may raise a question with respect to the quality as well as quantity. Further, concerning flows into the Cheyenne River, it was stated that it would not be necessary to have a stream flowing constantly in order to determine what might represent high flow or unappropriated water. For example, water left in pools at various points along the stream may suffice to provide that needed for domestic use. Then, of course, the matter of determining quality and the quantity of the water in the pools left in the stream would be subject to evaluation by interested parties.

It was explained that water might be stored to the extent of its loss into the limestone area. With respect to evaporation loss, that would be subject to the temperatures, the season, etc. In further reference to excess water, in the event of a heavy rain or storm the same condition exists as at the time of a heavy snow melt. There would be more water flowing downstream than could be put to use by those interested in using the same. In that case, it represents excess or unappropriated water.

Carrying the thought a step further, there might be ranchers on the Cheyenne River, for example, who could point to Battle Creek as a tributary and thus, an important segment of the Cheyenne River, since the Cheyenne River represents the contribution of various tributaries of that stream.

Measuring devices may be installed to record the in-flow to the proposed storage reservoir but even that would not tell the whole story.

Mr. Brophy asked, suppose several storage dams are built on the tributaries of Battle Creek, what effect would it have on the flow? Of course, the answer to that question would depend on the number of storage dams built, as well as a number of other factors.

Many times the flow downstream will show up heavier than the flow upstream. The point was made that if the reservoir is so located that water would be diverted directly into it at times of high flow with the natural flow to be passed that, in itself, would obviate the question which has arisen concerning the stoppage of water in the stream bed of the creek.

Mr. Colgan stated that it appeared we are in agreement as to when to store the water. The next question is how to pass the flash floods through the dam. Obviously a 12" pipe would not pass a flash flood in the surges that would be required to carry water over the limestone area. Mr. Rugg pointed out that under a nine foot head a 12" pipe would deliver about $8\frac{1}{2}$ cfs while under a 25 foot head the rate of delivery would be 14 cfs.

It was pointed out it might require some time to fill the reservoir from the level of the pipe to the emergency spillway.

Mr. Grimes stated if we assume that a flash flood did not exceed the capacity of the dam, the gate must be left open for a short time. With the gate left open, even then as the reservoir fills, a high head of delivery would be maintained as nearly as possible through the operation of the reservoir. As to the volume of water going through the pipe, to increase the velocity through the pipe, the friction loss increases as the square of the diameter of the pipe decreases.

If the pipe could be increased to 24" it would increase the flow about three times.

It is recognized that the flows which get into the Cheyenne River are really wasted water insofar as the users on Battle Creek are concerned. A question was directed to Mr. Rugg about the possible enlargement of the pipe.

One concern of the ranchers involved the time when the gate would be open. For instance, supposing a four inch rain were to occur at 2 A.M., the peak of the flood below the dam would have passed before anyone would be up to open the gate to release water which otherwise should have been released to add to the surge in sufficient volume to pass the sink holes in the limestone area as desired by the ranchers.

In response to a question concerning the size of the spillway over-flow, Mr. Rugg stated the plans call for an eight foot freeboard - the spillway is twelve feet wide so that they could handle about 1,200 cfs. Further, to prevent the pipe from plugging up, provision has been made for a boom to prevent trees and logs from jamming the pipe as well as the spillway. If the pipe were to be installed with a valve, then a question would arise concerning the operation of that valve. What would be expected in the way of regulation of that valve? Would it be left half open, a quarter open, or three fourths open, or open completely? This question was raised in consideration of the operators downstream.

The operators are concerned about rates of flow which would permit passage of water over the limestone. The handling of the valve could present a problem as it might be somewhat difficult

to regulate. Mr. Grimes asked Mr. Rugg if he could estimate the cost of doubling the size of the pipe. Mr. Rugg, stated, in his opinion, it would cost about five times that of a 12" pipe. He seemed to be of the opinion that it would cost around \$3,000. to install a 12" pipe while a 24" pipe might run anywhere between \$12,000. and \$15,000. This is merely an estimated guess subject to careful scrutiny and question.

Mr. Wergin stated that as Manager of Dakota West, Incorporated he desired a definite conclusion so they would know where they're at with respect to planning the commercial business development which is contemplated.

Mr. Grimes explained that in the event of any serious question, an appeal could be made to the Water Resources Commission, and beyond that an appeal could be made to the courts. Mr. Wergin asked, if there is no particular snow melt, when do we store water? Once water is stored in the reservoir the commercial enterprise would have the use of that water throughout the year.

Mr. Rugg pointed out there are only eight acres contemplated for a golf course and then it is only the greens that they are interested in watering. It would require about eight inches of water per week. The fairways will not be watered. Taking the optimum use, one inch per acre per week, or eight inches as in this case, per week, would be used. This figure is based on that used for cemeteries, golf courses, etc.

The question was raised - what about putting down a well, perhaps somewhere near Hermosa - in lieu of putting in a large pipe with valves, in the dam? In furtherance of that question

Mr. Rugg asked - suppose that they were to supply a one hundred thousand gallons of water by diversion from such a well, would they, the corporation, be allowed that amount of water diversion elsewhere? Mr. Grimes stated that the arrangement would be the same as in the relationship that now exists between Rapid Valley and Rapid City. However, if a well were to be put down, then the question would arise - would the water users between the dam and the well be satisfied?

It was stated that the creek had been dry between Hermosa and the sink area during the past six weeks.

Mr. Wergin called attention to the importance of having the issue clarified now because they want to avoid potential trouble at a later date.

With respect to any concern about establishing a precedent in granting the permit on Iron Creek, Mr. Grimes pointed out that any consideration to be given by the Commission goes through the same procedure as at the time the application is made for water on any given stream or from any particular source. He assured the group it is not the intent of the Commission to over-appropriate the waters of the stream.

The question was raised as to whether or not there were any political issues involved in the granting of water rights? To this the answer was 'no' - not as far as anybody could determine. The applicant still has the right of appeal to the courts. As a matter of fact, serving as an administrative agency, the Commission acts as a buffer between apparent conflicting interests and the courts.

If a federal case were involved, then the only solution would be through the courts. The United States does not maintain any water administrative agency such as we maintain in South Dakota and such as is maintained in the individual western states.

A navigable stream, as we know, is subject to Congressional jurisdiction, but is assigned to the Corps of Engineers for the handling of that jurisdiction.

Mr. Colgan, in summarizing, stated it appears that Dakota West, Incorporated can divert or store only the snow melt or excess waters when flowing in the streams, to the Cheyenne River. In any event, water is not to be stored at any time until after it is flowing at the mouth of Iron Creek. It was pointed out that domestic use has priority, hence the water users have a preference which is ahead of any storage rights that may be granted. It might be pointed out that when the snow melts in the hills, it is similar to the situation which prevails on the plains, that thawing or melting will develop about the same time, and perhaps take place a little faster on the plains than in the hills.

Mr. Colgan mentioned the fact that they felt they had been snubbed by the Forest Service officials when a meeting had been previously called for interested parties on Spring Creek and State Forest Service officials did not show up. Mr. Grimes indicated that by calling an official meeting, making it part of official state business, the Forest Service officials would have less occasion to ignore such a meeting when the group is called together to discuss problems of mutual interest. Mr. Colgan went on to point out that recently, Forest Service officials had been more considerate and it now appeared that

they would co-operate as necessary.

Mr. Grimes stated that in case of disagreement concerning the use of water, an agreement among the users themselves is the best arrangement that can be entered into. Likewise, agreements reached through the Commission would be better perhaps than the court decisions.

A question - what is the irrigation season? It is considered the season during which water can be applied beneficially. It is usually considered to be the growing season but this is not technically correct. For purposes of irrigation contracts, May 1st to October 1st has been defined as the irrigation season.

In further reference to the storage of water, Dakota West, Incorporated proposes an installation that is conceived and designed so as not to interfere with any existing water right on Iron and Battle Creeks. Mr. Rugg asked - will a water right obtained on a stream representing less than eight percent of a particular watershed actually hurt water users in the lower reaches of the stream? The answer - it may or may not hurt depending upon the facilities constructed and the time storage or use.

Mr. Grimes pointed out it is well for a group like this to get together in order that information may be exchanged and that which is obtained from both sides may be considered. It is the purpose of Dakota West, Incorporated to divert water at a time when others are not hurt.

Mr. Wergin again raised the question as to when water might be stored? Mr. Grimes stated that there is no question in the

minds of the Water Resources Commission that unappropriated waters exist. This water is spring runoff and other periods when flows are in excess of downstream needs. This water may be stored for later use. To what degree will facilities meet natural low flow conditions? This appeared to be a major question - how big should the outlet be?

Attention was directed to the fact that the water which gets into the Cheyenne River from Battle Creek is perhaps a measure unappropriated water which could be assigned to the corporation.

With respect to procedures involved, if someone or group consider themselves harmed, they may go directly to the Commission, or to the courts, or to the courts after the Commission had made its decision.

The installation of a recording gauge to record the reservoir level seemed to be one way of making the determination as to when the corporation would be entitled to store water. An automatic recorder would show the reservoir level. It would be necessary to change the paper once every eight days. It would have the advantage of showing the history of the elevation at all times.

It would be possible to put a recording gauge downstream below the outlet works on the dam, so as to measure overflow including that from the emergency spillway, if necessary. At present, a gauging station is maintained at Battle Creek below Hermosa. A person could put an accumulative reading gauge on the tube which would measure the rate of flow and provide an

accumulative record of the amount of water passed through. This appears to be unnecessary with a recording gauge on the reservoir.

With respect to the evaporation loss from the reservoir, it was pointed out that would be absorbed by Dakota West, Incorporated. On a small pond such as contemplated, the loss would approximate about 25 acre feet per year.

Again, in further reference to making an appeal, water users would have final recourse of appeal to the courts.

Mr. Grimes asked if after two years it is observed that the 12" pipe is not doing the job, then what? It was suggested perhaps a larger pipe could then be installed. The question would arise as to proof that the 12" pipe was not doing the job. The important thing is to replace the flows that would normally be in the creek during periods when such water is required and would satisfy downstream for domestic use and prior water rights. Mr. Grimes said he would re-examine the question in the light of the information that had been presented and discussed. To assume that the only source of water in Battle Creek was in Iron Creek and was 50 cfs, the loss during four hours would be much less than with an 8 cfs discharge over a period of 25 hours. To increase the flow over a longer period of time would also increase the loss. If we were thinking in terms of ten drops of water out of fifty, out of Iron Creek contributing to the loss, it would be impossible to measure. The first 3 cfs water to hit the limestone area will provide the water loss regardless of the source. It is entirely conceivable that water from tributaries, other than Iron Creek, would be the first to hit

the loss area, therefore, providing all of the loss involved. Giving further consideration to this phase of run-off, we know that not all of it would reach the loss area at the same time. Water on the flatter upstream surface tributaries could be a couple of days later, depending upon the amount of rain, drop in elevation, and other factors involved. It is possible to get at the flow relationships to rain in reaches of the river. Sometime during the flood flow period, when the gates are open, it will prove beneficial. Flows in the streams spread out over enough time so that above the loss area it builds up rapidly to a peak but levels off toward Hermosa. If we were to superimpose operations of a reservoir, it would peak up a little lower and lengthen out the flow after the flood peak. For illustrative purposes, reference was made to a graph. Any flows greater than 3 cfs would get beyond the loss reaches of the stream.

It was also pointed out that perhaps it would be possible to install an electronic device which would actuate a conditioner to open the valve. This would be automatic, but it would be expensive, too.

It was suggested that it would be well to install a measuring device in the loss area, say just above the loss area.

Consideration was given to ways and means by which the dam would help, by storing up water and then releasing it in slugs to carry over the limestone area in time of a low flow. This would be very helpful.

It would involve a problem for the operator in handling the operation of a reservoir under those conditions. In any

event, the operation of a reservoir has to conform to that which is outlined in a permit. The question was asked if the ranchers were to bargain for the release of water at certain times, could an equivalent amount be stored or replaced at other times? The answer - "yes, it is possible". It would be a matter of trading among the water users. For example, if an emergency were to arise, an agreement between the water users and the corporation would be all right as long as it did not violate provisions of the law. The Commission must make the determination as to whether or not other water users are injured under such an arrangement. If such arrangement were made, a copy should be sent to the Water Resources Commission so that it could be put into the water right records.

Mr. Grimes stated that in dry seasons the stream beds get so dry, it takes a lot of water to soak up the bed.

Reference was made to the Carl Brown report prepared in 1944 concerning Battle Creek. It was made for Senator Francis Case. In that report it was pointed out that the loss in the limestone area ranged from 80% to 90%, whereas in the sandstone area the loss would range from 10% to 15%. Mr. Grimes called attention to some work that had been done on French Creek, where a pipe had been installed to carry water through a sink hole area. Since that 12" pipe has been installed, capable of carrying about 5cfs for 3,600 feet, there has been, apparently, better supply⁴⁵ of water in wells in the area, whereas before the installation, wells going dry in the French Creek area seemed to be a common occurrence at certain times of the year.

In response to a question as to how a watershed plan would work, it was pointed out that here, there is interest in low flows which is just the opposite for purposes of a watershed. Furthermore, the Soil Conservation Service Watershed Program, under Public Law 566, is limited to an area not to exceed 250,000 acres. If it is larger than that for handling water, it naturally goes to the Corps of Engineers for one of their projects.

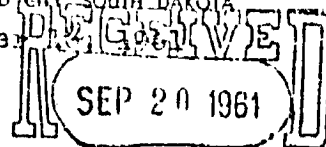
It might be concluded that this conference was useful even though no definite decisions were reached at the time. Mr. Grimes again assured the group that he would make a study of the situation.

RAYMOND F. LUND
District Specialist



P. O. BOX 1072 ■ PHONE FI 3-0222 ■ 1703 WEST ST. JOE ST. ■ RAPID CITY, SOUTH DAKOTA

September



Mr. Raymond Lund
State Water Resources Commission
Pierre, South Dakota

STATE WATER RESOURCES COMM.
PIERRE, SOUTH DAKOTA

Dear Mr. Lund:

In accordance with your request at our meeting this morning I submit herewith the data which was cited there relative to proportional drainage areas, channel losses in the "sink hole" zone below Hayward and our presently planned water use rate.

The data cited was taken from "Field Examination Report, Battle Creek Watershed. Custer and Pennington Counties, South Dakota, September, 1955"; a survey conducted by the Soil Conservation Service and the U. S. Forest Service in the interest of promoting a watershed development project for Battle Creek.

Page 4: "Peak flows of 1520 cfs.....have been recorded at Hermosa from the 172 square miles of drainage area."

Page 9: "The drainage area of Battle Creek below the confluence of Iron Creek is about 60 square miles." (Underlining is mine.)

The above data seemed to indicate that the drainage area above the confluence of Iron Creek would be 172-60, or 112 square miles. It was this value which I used in estimating that the drainage area (12.7 square miles) above our proposed dam site constituted only about 11.3% of the Battle Creek watershed above the confluence of Iron Creek. This interpretation of the above data I now believe to be in error because it assigns too small a value to the downstream portion (possibly the area meant was Battle Creek only, without Grace Coolidge Creek and other tributaries) and too large a value to the upstream portion. The idea of estimating the approximate percentage of the upper drainage reaches contributing to the proposed reservoir did not occur to me until shortly before our meeting this morning and I "called the shots as I saw them" in the light of the above data, without too much time for a re-check of drainage areas involved.

A more accurate picture, I believe, is given in Carl Brown's "Report of an Investigation of Water Losses in Streams Flowing East out of the Black Hills", made in 1944 at the request of Senator Case. On page 16 he writes: "Battle Creek crosses the outcrop of the Englewood limestone about 1700 below Hayward, an old mining camp at the National Forest boundary. Above this point the drainage area is approximately 68 square miles." This checks much better with our findings, as determined from USGS quadrangles. Iron Creek joins Battle Creek about 1/4 mile above Hayward.

Using this value we conclude that the drainage area tributary to the proposed reservoir would constitute about 18.68% of the total drainage area above Hayward and would probably contribute 18.68% of the flow in Battle Creek at Hayward, assuming no diversion or impedance of the natural runoff. If this reasoning is allowable it follows that 18.68% of the loss in the "sink hole" section downstream from Hayward probably comes from the proposed reservoir drainage area.

Both the above quoted reports indicate that the average annual loss in this zone is determined to be on the order of 2.7 to 3.0 cfs, or 1.75 to 1.94 MGD. Of this "lost water" 18.68%, or 0.33 to 0.36 MGD, may reasonably be assumed to have originated in the drainage area tributary to the reservoir. The maximum summer use rate for the resort in its revised ultimate stage, with 8 acre-inches per week allowed for sprinkling of greens and lawns would average about 96,200 GPD; say, 0.1 MGD. This is less than 1/3 of the present estimated "sink hole" loss of water reasonably assumed to originate in the reservoir drainage area. In view of the foregoing, it is difficult to see how diversion of this much water at the location proposed will infringe in the slightest upon the rights of anyone downstream from Hayward, regardless of their priority in terms of either chronological filing or nature of use.

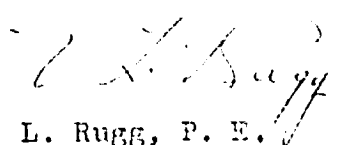
Mr. Colgan placed considerable emphasis on impedance of storm water runoff by the proposed reservoir, when it is partly filled, and cited the example of Sheridan Dam on Spring Creek to illustrate how this can work a hardship on holders of water rights downstream. Although not too familiar with the Spring Creek watershed, it seems that the two cases are too far apart in scope to be comparable. It may well be that Sheridan Dam, with its great area and massive storage basin dominating a large portion of the Spring Creek watershed, does create a hardship on water right holders downstream by reason of flash flood impedance. It is difficult to see how this proposed reservoir with 115.2 acre feet of storage and 10.2 acres of area, supplied by only 7.38% of Battle Creek's 172 square miles of drainage area upstream from Hermosa, can be considered a significant factor in runoff impedance; especially in view of the planned program of storm water releases on the order of 8 to 14 cfs (depending on available head) to restore the reservoir to pre-storm level.

We feel that much was accomplished in the way of clearing up misunderstandings at the meeting. For myself, I was glad to have the term "waters of Battle Creek" explicitly defined as the waters present in the channel above ground or in the alluvial deposits underlaying or contiguous to the main channel, including its tributaries. This serves to clarify the nature of waters subject to appropriation and whether there is, in fact, waters available for appropriation, regardless of location within the watershed.

This project was conceived and designed to be operated in a manner to fully protect the rights of those downstream and, recognizing the particular characteristics of the watershed, we believe it will so function. To have approached the problem in any other manner would have been a violation of moral and professional ethics.

Very truly yours,

STAVEN ENGINEERING COMPANY

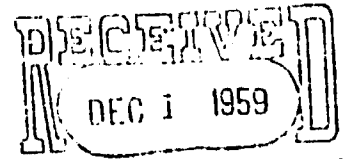

V. L. Rugg, P. E.

VL.R:lmw

CC: Mr. Wergin

Nº 23961

State of South Dakota



STATE WATER RESOURCES COMM.
PIERRE, SOUTH DAKOTA

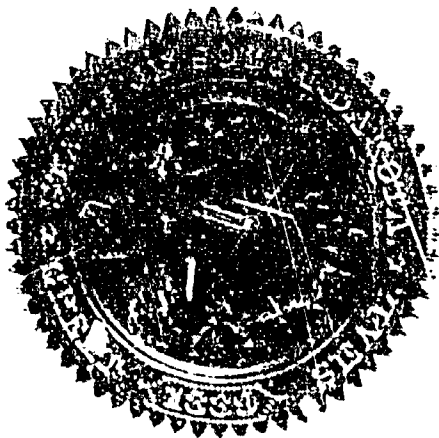
Department of State

United States of America, } Secretary's Office
State of South Dakota, }

*This is to certify that the attached instrument of writing
is a true, correct and examined copy of*

Articles of Incorporation of DAKOTA WEST CORPORATION as filed
in this office on December 21, 1951.

*and the whole thereof, and has been carefully compared with
the original now on file in this office and found correct.*



In Testimony Whereof, *I have herunto
set my hand and affixed the Great
Seal of The State of South Dakota
at the City of Pierre, the Capital on
this 23rd day of November 19 59*

John Anderson
Secretary of State.

FEES. \$ 2.50

BY _____
Assistant Secretary of State

John T. Lauer, atty
Huron S D

RT

ARTICLES OF INCORPORATION

OF

DAKOTA WEST CORPORATION

Know All Men By These Presents:

That we, the undersigned Samuel D. Luak, Jeannette C. Luak and Floy A.
C. Willard

for ourselves, our associates and successors, have associated ourselves together for the purpose of forming a corporation under and by virtue of the statutes and laws of the State of South Dakota, and we do hereby certify and declare as follows, viz:

FIRST

The name of this corporation shall be DAKOTA WEST CORPORATION

SECOND

The purpose for which this organization is formed is: Directly, or through ownership of real estate and property, either improved or unimproved, and any interest therein; to own, hold, control, maintain, manage, and develop the same; to erect, construct, maintain, improve, rebuild, enlarge, alter, manage, operate, and control all kinds of buildings, houses, hotels, apartments, stores, offices, warehouses, mills, shops, factories, machinery, and plants, and all structures and erections of any description on any lands owned, held, or leased by the corporation, or upon any other lands; to lease or sublet offices, stores, apartments, and other space in such building or buildings, and to sell, lease, sublet, mortgage, exchange, assign, transfer, convey, pledge, or otherwise alienate or dispose of any of such real estate and property, and any interest therein. Directly, or through ownership of stock in any corporation, to purchase or otherwise acquire, hold, manufacture, sell, exchange, mortgage, pledge, hypothecate, deal in, and dispose of commodities, building materials, and other personal and real property of every kind, and any interest therein. To borrow or raise moneys for any of the purposes of the corporation and, from time to time, without limit as to amount, to draw, take, accept, endorse, execute, issue, and grant promissory notes, drafts, bills of exchange, warrants, certificates, bonds, indentures, and other negotiable or non-negotiable instruments, evidences of indebtedness and agreements; to secure the payment thereof and of the interest thereon and the performance thereof by mortgage, pledge, or lien, assignment, or assignment in trust of the whole or any part of the assets of the corporation, whether at the time owned or thereafter acquired; and to sell, pledge, or otherwise dispose of such securities or other obligations of the corporation for its corporate purposes. To purchase or otherwise acquire, undertake, carry on, improve or develop, all or any of the business, good will, rights, assets, and liabilities of any person, firm, association, or corporation carrying on any kind of business of a similar nature to that which this corporation is authorized to carry on, pursuant to the provisions of this certificate; and to hold, utilize and in any manner dispose of the rights and property so acquired. To manufacture, mine, quarry or otherwise produce minerals, ores or other mineral substances from the real estate holdings of said corporation. To exercise all or any of its corporate powers in any state, territory, possession or dependency of the United States, and in any foreign Country. To do everything necessary, proper, advisable, or convenient for the accomplishment of any of the purposes, or attainment of any of the objects, or the furtherance of any of the powers herein set forth, either alone or associated with others, provided the same be not inconsistent with the laws of the State of South Dakota.

THIRD

The place where the principal business of this Corporation shall be transacted is _____
Huron _____ in the County of Beauregard _____
 State of South Dakota, but a business office may be located at _____
Rapid City, South Dakota _____ where meetings of the directors and stock-
 holders may be held for the transaction of business.

FOURTH

The term for which this Corporation shall exist shall be perpetual years.

FIFTH

The number of directors of this Corporation shall be THREE (3)
and the names and residences of such who are to serve until the election of their successors are as follows:

NAMES	RESIDENCES
Robert D. Lusk	Huron, South Dakota
Jeanette C. Lusk	Huron, South Dakota
Floyd L. Willard	Huron, South Dakota

SIXTH

The amount of Capital Stock of this Corporation shall be and is
 ONE HUNDRED SIXTY TWO THOUSAND (162,000.00)*****DOLLARS
 Divided into Sixteen Hundred Twenty (1620) shares
 of the par value of ONE HUNDRED (\$100.00) DOLLARS
 each, fully paid and nonassessable.

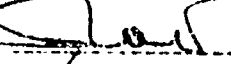
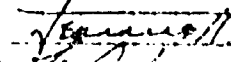
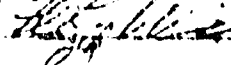
SEVENTH

The resident agent of this Corporation upon whom service of process may be made, shall be _____ of _____, South Dakota, and service upon him shall be taken and held as due and personal service upon this Corporation.

NOTE: (The above article applies only to Corporations of this State not doing or carrying on business within this State.)

No stockholder shall be liable for the debts of the Corporation in any amount greater than his unpaid subscription.

IN TESTIMONY WHEREOF, We have hereunto set our hands and
day of December, 1951.


 Samuel C. Lusk
 1. 
 Fayette C. Lusk
 2. 
 H. J. Willard

STATE OF SOUTH DAKOTA }
County of Beadle } ss.

BE IT REMEMBERED, That on this 19th day of December
A. D. 1951, before the undersigned personally appeared the above named
Robert D. Lusk, Jeannette C. Lusk and Floyd A. Willard

well and personally known to me to be the same persons described in and who executed the fore-
going instrument and severally acknowledged to me that they executed the same.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal
at said County the day and year last above written.

Notarial Seal.

Evelyn Martingel
Notary Public.

STATE OF SOUTH DAKOTA }
County of _____ } ss.

BE IT REMEMBERED, That on this _____ day of _____
A. D. 19____, before the undersigned personally appeared the above named _____

well and personally known to me to be the same person described in and who executed the fore-
going instrument and severally acknowledged to me that he executed the same.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal
at said County the day and year last above written.

Notarial Seal.

Notary Public.

STATE OF SOUTH DAKOTA }
County of Beadle } ss.

Robert D. Lusk and Floyd A. Willard

BEING DULY SWORN, each for himself deposes and says: That he is one of the persons described in
and who signed the foregoing Articles of Incorporation as an incorporator therein; that he has read
said Articles and knows the contents thereof; that the incorporators intend in good faith to form a
corporation for the purpose of the promotion of a lawful business as set forth in said articles and not
for the purpose of enabling any corporation or corporations to avoid the provisions of Chapter 13.18
South Dakota Code of 1939, relating to unlawful trusts and combinations and laws amendatory
thereto.

[Signature]
Floyd A. Willard

Subscribed and sworn to before me this _____

19th day of December, A. D. 1951.

Notarial Seal.

Evelyn Martingel
Notary Public.

DEC 21 1951
35/5

Conversation or File Documentation

NAME OF PERSON OR FILE: Lee. Leffert, US Forest Serv.ADDRESS: Custer COUNTY _____DATE: 10-27-83 TELEPHONE 673-2251RE: Dakota West Corp.

COMMENTS:

Leffert called regarding copy of water Permit Application to appropriate water .668 cfs from Iron Creek to irrigate golf greens with up to 117 A.F. per year.

The diversion point and point of use are located on Forest Serv lands.

If we get application please call Leffert to discuss application, if land description as submitted is on Forest Serv. land, contact applicant. Application should not be processed until land ownership question resolved.

10-28-83 563-2 was originally issued to Dakota West Corp. was transferred to USDA Forest Service May 14, 1970 called Lee and told him about it. Kevin C. Brown

File in Permit or other file as necessary. Use to document conversations and what the other party was told; why action or decision was made.

NAME: _____

John Hatch

Water Rights Division
605 773-3352

November 14, 1983

563-2

Lee Leffert
U.S. Forest Service
PO Box 742
Custer SD 57730

Dear Mr. Leffert:

Enclosed herewith is reissued Water License No. 563-2. This is the final water right document completing your process of obtaining a water rights.

As long as you use the water beneficially, as stated in the Water License, the State Water Laws provide that you have a continuing right to use the water.

Very truly yours,

JOHN HATDB, Chief Engineer
Water Rights Division

JH:ks

enclosure

State of South Dakota

REISSUED Water License No. 563-2

(1) Dakota West Corporation
of Huron, South Dakota
made Application No. 563-2, December 1, 1959 for a water permit to appropriate
0.66 cubic feet per second of water from a 115.2 acre foot storage dam to be constructed on
Iron Creek, Custer County, South Dakota for recreation, irrigation and commercial purposes.
Permit No. 563-2, with a priority date of December 1, 1959
was approved February 1, 1960 and issued to applicant(s) for diversion of water with construction of the described
water supply system to be completed on or before January 26, 1965 and for the application to beneficial use of said
water on or before January 26, 1966.

Remarks:

- A. This water license replaces the license issued July 8, 1970 by J.W. Grimes, License No. 563-2 is reissued to clarify the entitled storage of the Reservoir.
- B. Reissued Water License No. 563-2 is based on "Report of Examination of Works" dated May 4, 1970 by Donald Driscoll.
- C. The appropriation of water under this license allows storage of 115.2 acre feet of water and authorizes the annual storage of the quantity of water needed to fill the reservoir to spillway elevation subject to downstream domestic uses and prior water rights. Upon reaching spillway elevation in any year, the appropriation has been satisfied and any inflows must be released as needed by downstream uses.
- D. Previously named Biltmore Lake, the Reservoir is now referred to as Lakota Reservoir.
- E. May 18, 1970, the permit was transferred to the United States of America for administration by the Forest Service.

and

(2) It is certified that the application has complied with the provisions of South Dakota State Law relating to completion of
the construction of the water supply system and is entitled to store up to 115.2 acre feet annually (see remarks)
for beneficial use. The location of the diversion point(s) is 1177 feet S43°05'E from the NW corner of
Section 27, T2S, R6E BB

and

(3) The applicaant has complied with the provisions of South Dakota State Law relating to the application of water to beneficial use to the following extent, water is used for public recreation purposes

(4) Pursuant to §16-5-30.1 the U.S. Forest Service, PO Box 742
of Custer, South Dakota
the holder(s) and/or owner(s) of Water Permit No. 563-2 is issued a license to appropriate water, the right to use 115.2 acre feet of water stored in Lakota Reservoir and the replacement thereof from
cubic feet per second of water from Iron Cr. on an annual one-time basis with a priority date
of December 1, 1959 from the location specified in (2) of this license. The water to be
used
~~conducted to and upon lands specified in (3) of this license~~ for the purpose of recreation

reissued and is
This license is subject to any limitations or qualifications listed in Water Permit No. 563-2 and subject
to South Dakota State Law.

Chief Engineer, Water Rights Division
Department of Water and Natural Resources

November 14, 1983