

No. *U.S. 5173*

Office of State Engineer
DOCUMENT FILE

*U. S. Dep't of Interior
Bureau Biological Survey
Missouri River District
Lake Under Waterford
Chas. Mearns County*

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WATER RESOURCES
WATER RIGHTS

NOTICE OF INTENTION
to the
STATE ENGINEER
of the
STATE OF SOUTH DAKOTA

RECEIVED
APR 22 1940
OFFICE OF STATE ENGINEER
PIERRE, S. DAK.

Lake Andes Migratory Waterfowl Refuge Project

Charles Mix County

County

Date April 17, 1940

Notice of Intention to divert, store and appropriate water for beneficial uses from certain streams in South Dakota by the United States of America, Department of the Interior.

The United States of America, Department of the Interior, Bureau of Biological Survey, hereby notifies the State Engineer of South Dakota of its intention to appropriate, by construction, diversion, storage and beneficial use, the unappropriated public waters of South Dakota, under Section 61.0137 of the 1939 Revised Code of South Dakota. Application is hereby made for the withdrawal of certain unappropriated public waters of the State of South Dakota in an amount sufficient to maintain storage in Lake Andes, or to satisfy the requirements of the diversion ditches, canals or pipe lines to be constructed and the following information is furnished:

1. Representative of the United States of America authorized to act in procurement of water rights:

Ans. Brice McBride, Hydraulic Engineer.

2. Name of intending appropriator:

Ans. United States of America.

3. Name and address of agency representing intending appropriator.

Ans. United States Department of the Interior, Bureau of Biological Survey, 437 Federal Building, Salt Lake City, Utah.

4. Name of reservoir, ditch, canal or pipe line.

Ans. Lake Andes, West Diversion Ditch.

(a) Andes Creek (b) Reynolds Creek (c) Shank Creek (d) Picotte Creek (e) Stewarts Creek (f) Dezera Creek (g) Hutchinson Creek (h) Hunters Creek (i) Vandall Creek (j) Irving Creek, diverted into acquisition area, thence to Lake Andes proper (k) Garden Valley Creek diverted to Hutchinson Creek by means of West Diversion Ditch (l) also all other coulees, streams or drainage directly tributary to Lake Andes.

5. County in which water is to be diverted, stored and appropriated.

Ans. Charles Mix.

6. Name of stream from which water is to be diverted, stored and appropriated:

Ans. (a) Andes Creek (b) Reynolds Creek (c) Shank Creek (d) Picotte Creek (e) Stewarts Creek (f) Dezera Creek (g) Hutchinson Creek (h) Hunters Creek (i) Vandall Creek (j) Irving Creek, diverted into acquisition area, thence to Lake Andes proper (k) Garden Valley Creek, diverted to Hutchinson Creek by means of West Diversion Ditch (l) also all other coulees, streams or drainage directly tributary to Lake Andes.

7. The outlet of the reservoir or the point of diversion of ditch, canal, or pipe line is located South 2430 feet and West 560 feet distant from the NE corner of Section 9, Township 96N, Range 65 West.

(a) Outlet to reservoir is a combination ditch and 5 ft. reinforced concrete pipe.

(b) West diversion ditch consists of blocking the Garden Valley Creek channel and diverting the water by means of an open diversion ditch to the Hutchinson Creek, which enters the lake basin 1720 ft. south and 670 ft. west of the NW corner of Section 3-37-65.

(c) Andes creek enters lake via marsh area at extreme north end of lake.

(d) Reynolds Creek enters lake 630 ft. East of the Southwest corner of the N.W. $\frac{1}{4}$ section 16-97-64.

(e) Skunk Creek enters lake via marsh area in Section 20-97-64.

(f) Picotta Creek enters lake 530 ft. east of the S.W. corner of the N.E. $\frac{1}{4}$ Section 31-97-64.

(g) Stewarts Creek enters lake 1220 ft. south and 615 ft. east of the N.W. corner Section 1-97-65.

(h) Dezora Creek enters lake S.W. Corner of the NW $\frac{1}{4}$ of the NE $\frac{1}{4}$ Section 2-97-65.

(i) Hunter Creek enters lake 1180 ft. North and 225 ft. East of the S.W. corner of the NW $\frac{1}{4}$ of NE $\frac{1}{4}$ Section 11-97-65.

(j) Vandall Creek enters lake 1250 ft. N. of S.W. Corner of S.E. $\frac{1}{4}$ of S.W. $\frac{1}{4}$ Section 1-97-65.

(k) Irving Creek enters lake by diversion through acquisition area.

(l) Also all other coulees, streams or drainage directly tributary to Lake Andes.

8. Uses to which water directly diverted or diverted and stored is to be put.

Ans. Water conservation and for the propagation and growing of aquatic vegetation on a Federal migratory waterfowl refuge as provided in the Federal Migratory Bird Conservation Act of February 18, 1939, and all acts which may be amendatory thereto.

9. The available capacity of reservoir in acre feet.

Ans. North Dike at 100.0' spillway crest, 3015 acre feet. (Dike No. 1)
South Dike at 97.0' spillway crest 10360 acre feet. (Dike No. 2)

Total 13375 acre feet.

10. The carrying capacity of ditch, canal, or pipe line in cubic feet per second.

Ans. For all streams or coulees entering the lake directly, total flow estimated at from 0 cubic feet to 160 cubic feet. All creek flow only during run-off periods. Capacity is dependent on rain-fall or spring run-off (snow).

11. Acre feet of water to be appropriated annually for diversion and storage in reservoir.

Ans. Sufficient to fill lake to maximum capacity of 13,375 acre feet, and in addition sufficient to maintain lake at maximum elevation but in no case will this latter exceed 6,964 acre feet annually.

12. Cubic feet of water per second to be appropriated for direct diversion by ditch, canal, or pipe line.

Diversion ditch inlet via Hutchinson Creek, 100 cu. ft. per second.

13. Location of lands to be irrigated.

Ans. Area within Lake Andes shore line being parts of Sections 9, 10, 15, 16, 20, 21, 28, 22, 29, 30, 31, 32, and 33, Township 97 N., Range 64 W., Sections 5 and 6, Township 96 N. Range 64 W., Sections 1, 2, 3, 9, 10, and 11, Township 96 N. Range 65 W.

14. Class of plans accompanying "Notice of Intention".

Ans. Proposed and preliminary.

UNITED STATES OF AMERICA

By

Brice M. McBride

Brice McBride, Hydraulic Engineer,
Bureau of Biological Survey

WITHDRAWAL NO. U. S. 517Lake Andes Migratory Waterfowl Refuge
(Name of Project)Water Division No. 3Missouri River Water District

NOTICE OF COMPLETION OF WORKS

P. O. Salt Lake City, UtahDate May 6, 1942

TO THE STATE ENGINEER OF SOUTH DAKOTA, PIERRE:

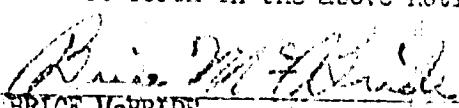
Dear Sir: Notice is hereby given of the completion of the construction of Dike #1 and Dike #2 and diversion ditches, or pipe line constructed and owned by the United States of America, Department of the Interior, Fish and Wildlife Service, (formerly the Bureau of Biological Survey) on Lake Andes and tributary creeks. The project provides for the diversion and storage or direct diversion of quantities of water as shown on the plans and reports submitted and the project has been completed in accordance with the said plans and reports, terms and conditions of withdrawals heretofore issued by the State Engineer of the State of South Dakota or as shall be hereafter reported by the Examining Engineer.

1. The proper name of the Federal Agency holding said withdrawal is the United States of America, Department of the Interior, Fish and Wildlife Service.
2. The name and postoffice address of the proper corresponding official for said Federal Agency, is Erice McBride
Sr. Hydraulic Engineer, 436 Federal Bldg, Salt Lake City, Utah.
3. The project is located in _____ of Section _____
Township 97 and 96 N. Range 64 and 65 W.
4. Said water to be used for water conservation and propagation
of aquatic vegetation purposes.
5. The amount of water which said completed works are capable of impounding or conducting to the place of intended use is as shown by information previously submitted or as shall be hereafter reported by the Examining Engineer 20,350 ac-ft.

Form 17A - Withdrawal No. U.S. 517 - Sheet 2.

6. The amount of land for which said water is available is
(see map), particularly described as follows: Area
within shore line of Lake Andes.

I hereby certify that the facts set forth in the above notice are true.


BRUCE MCBRIDE

Sr. Hydraulic Engineer
U. S. Fish and Wildlife Service
Department of the Interior

CROSS REFERENCE

SEE FILE: U.S. 1-3

- Re: 1. Letter dated March 16, 1948 from: Arthur J. Huey
Regional Engineer
U. S. Department of the Interior
Fish and Wildlife Service
828 Plymouth Building
Minneapolis, 2 Minnesota
2. And answer to above from Mr. Loucks

SUBJECT: U. S. Fish and Wildlife
South Dakota Water Certificates

LETTER OF AUTHORIZATION

for
Inspection

May 15, 1942

Robert W. Dougall

Box 638, Minot, North Dakota

Lake Andes Migratory Waterfowl Refuge
(name of project)

Lake Andes and tributary streams.
(Source of Appropriation - Stream)

Dear Sir:

The United States of America, Department of the Interior, Fish and Wildlife Service (formerly the Bureau of Biological Survey) having filed "Notice of Intention" to utilize certain specified waters of the State, and there having been issued a withdrawal from further appropriation as provided in Section 61,0137, 1939 Revised Code of South Dakota and identified as Withdrawal No. U.S. No. 151, on Lake Andes Tributaries (stream), County of Charles Mix, has informed this office that the construction for the diversion, storage, appropriation and application of water to beneficial use has been fully completed and is ready for examination.

You are, therefore, hereby authorized to arrange with the holder of said withdrawal for an examination of the Lake Andes dikes, reservoir, and diversion ditches ditch, or pipe line constructed and owned by the United States of America, Department of the Interior, Fish and Wildlife Service, on the Lake Andes Migratory Waterfowl Refuge and also an inspection to determine the amount of water stored and applied to beneficial use.

In this examination you will ascertain whether or not the constructed works comply fully with the plans submitted and are capable of using quantities of water as set forth in the "Notice of Intention", and give in complete form all the information which is suggested by the statements in the Certificate of Inspection which is herewith enclosed, in the attached instruction, and such other information as will enable the State Engineer to act intelligently and judiciously in the matter of determining the status of completion of the projects.

You should also arrange with the holder of the withdrawal for the payment of your fee for this service and such proper expenses as you incur in making this examination and report and taking the testimony.

Very truly yours,

Robert W. Dougall
State Engineer

IN REPLY REFER TO

R
Lake Andes
Water Filings

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF BIOLOGICAL SURVEY

437 Federal Building
Salt Lake City, Utah

RECEIVED
APR 22 1940

OFFICE OF STATE ENGINEER
PIERRE, S. DAK.

April 17, 1940

Mr. Dean W. Loucks,
State Engineer,
Pierre, South Dakota.

Dear Mr. Loucks:

Attached please find the Notice of Intention and Certificate of Withdrawal, and plans to accompany same, to cover water filings on Lake Andes by the Biological Survey.

As indicated in Paragraph 14 of the Notice of Intention, the plans are proposed and preliminary; hence, subject to revision when more field data has been obtained. Any discrepancies between the descriptions furnished in the Notice of Intention and the map would be corrected during the following steps necessary to complete the filing.

Very truly yours,

Brice McBride

Brice McBride,
Hydraulic Engineer

ENCLS: Notice of Intention
Certificate of Withdrawal
B. S. Drawings Nos. M-S.D.2-4.0
2-5.0
2-6.C
2-7.0

CC to Washington
Mr. Maurek
Mr. Van Kent

WITHDRAWAL NO. 517Water Division No. 5Missouri River Water District

CERTIFICATE OF EXAMINATION OF WORKS
Report of Examining Engineer

Date December 15, 1943Lake Andes Migratory Waterfowl Refuge

Lake Andes and Tributary Creeks
Source of Appropriation
(Stream)

To the State Engineer, Pierre, South Dakota:

Dear Sir: I hereby certify that in accordance with your letter of authorization dated May 5, 1942, 19 42, I have made a thorough examination of Lake Andes Refuge Dam, constructed by the United States of America, Fish and Wildlife Service, holder of withdrawal No. U. S. #517, issued upon Certificate of Withdrawal bearing date April 17, 1940, authorizing the withdrawal from further appropriation of waters of Lake Andes and tributary creeks, for water conservation and propagation of aquatic vegetation, fish and recreation purposes.

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

The impounded and diversion works comprise:

Dam No. 1: Type Earth fill, gravelled roadway on top Foundation Clay
Size: Max. Length 2875 ft. Max. Height to spillway 8 ft.

flow line elevation 93.0 Freeboard 4 feet

Section: Upstream slope 3:1 slope from top of dike
(elevation 104) to elevation 101 then on level berm for horizontal
distance of 6 feet and then 5:1 slope on down to natural ground

Downstream slope 6:1Top width 26 feetYardage 2,036 (approximately)Reservoir: Area Normal Pool Level 611 acresCapacity 2,683 acre feetNature of shore line marsh - lake bottom loamsSpillway: Type stoplog overflow combination spillway and outlet

Location 850 feet west of east end of dike near 1/4 corner
common to Sections 16 and 21, T. 97 N., R. 64 W.

Width 20 feet Depth 2 feet Capacity 185 c.f.s. with
stoplogs in place

Outlet: Size 2 bays 4' wide and 8' deep and 2 bays 4' wide and 2'
deep Control Concrete stoplogs Location in
combination with spillway

Ditches: NoneDam No. 2: Type Earth fill and gravelled roadway on top Foundation ClaySize: Max. Length 2,085 ft. Max. Height to spillway 7 ft.flow line elevation 90.0 Freeboard 4 feet

Section:	Up stream slope	6:1
	Downstream slope	6:1
	Top width	20 feet
	Yardage	97,300 (approx.)
Reservoir:	Area Normal Pool Level	1,660
	acres	Capacity 11,038
	Nature of shore line	marsh-lake bottom loams
Spillway:	Type	stoplog overflow combination spillway and outlet
Location:	Near center of dam	Width 20 feet
		Capacity 185 c.f.o.
	with stoplogs in place	
Outlet:	Size	2 bays 4 feet wide and 7 feet deep and 2 bays 4 feet and 2 feet deep
	Control	Concrete stoplogs
	Location	in combination with spillway
Ditches:	None	

Garden Valley

Creek Diversion Point of diversion into ditch is a dumped rock block in Garden Valley Creek 2,330 feet east and 2,520 feet south of the N.W. corner of Section 5, T. 96 N., R. 65 W.

Ditch: Open earth Length 14,885 feet Section 10 feet bottom 1:1 side slopes Capacity 200 c.f.s. Location Beginning at the point of diversion in Garden Valley Creek thence running S. 58° 15' E. 1,920 feet; thence N. 0° 0' E. 3,340 feet; thence S. 90° 0' E. 1,155 feet; thence S. 0° 0' E. 740 feet; thence S. 90° 0' E. 7,940 feet. From here, the diverted water follows the natural channel of Hutchinson Creek, which enters the lake basin 1,720 feet south and 670 feet west of the N. E. corner of Section 3, T. 96 N., R. 65 W.

The System is in the following condition: The dikes are in excellent condition, all riprap being well in place. Spillway and outlet structures are in excellent condition except for a few chipped or broken stoplogs. Some erosion has taken place along west diversion ditch, but it is in generally good condition.

The outlet of the reservoir or the point of diversion of the ditch, canal or pipe line is located 2,850 feet north and 560 feet west of the S.E. corner of Section 9, Township 96 N., Range 65 West.

The works are capable of utilizing 15,721 acre-feet of storage annually plus 6,817 acre-feet for seasonal use.

The legal subdivisions to be irrigated are:

Dam No. 1: All lands in Sections 9, 10, 15 and 16, Township 97 North, R. 64 West, lying below the 97 contour comprising a total of 611 acres of land.

Dam No. 2: All lands in Section 6, Township 96 N., Range 64 West, and Sections 1, 2, 3, 4, 9, 10, 11 and 12, Township 96 North, Range 65 West, lying below the 100 contour comprising a total of 1,660 acres of land.

Said contours for dams No. 1 and 2, having been established from a bench mark described as the top of the center pier in a stoplog structure, located between the abutments of a bridge in State Highway #18, over the outlet channel of Lake Andes near the east 1/16 line of the N. E. $\frac{1}{4}$, Section 9, T. 96 N., R. 65 W.

The domestic and stock watering uses comprise use by cattle that are grazed on area under permit on refuge.

The utilization for public recreation, game and fish propagation, fire protection, comprises: Principal use for migratory waterfowl refuge - supplemental use, game and fish propagation, public recreation.

Notice of completion of works was filed May 11, 1942

Witness my hand, this 3rd day of February A.D. 19 48.

Robert W. Doregan
Examining Engineer

March 11, 1943

Arthur G. Huey, Regional Engineer
United States Department of Interior
Fish and Wildlife Service
Office of Regional Director
828 Plymouth Building
Minneapolis 2, Minnesota

Re: Lake Andes Water
Withdrawal No. U. S. 517-3

Dear Mr. Huey:

This will acknowledge receipt of your letter of February 4, 1948 enclosed certificate of Examination of Works as prepared by Examining Engineer R. W. Dougall.

We have prepared and are enclosing herewith a certificate of Construction of Works and Appropriation for the withdrawal of water as provided for under withdrawal No. U. S. 517-3. Our state code requires that we charge a fee of one dollar for issuing each certificate of construction. You will therefore kindly remit to this office in that amount.

I believe this completes the filing of documents in this office to entitle the holder of the Certificate of Construction and Appropriation to full enjoyment of the water as set forth therein and for the purposes provided.

It would however perhaps be desirable to have the Certificate of Construction and Appropriation recorded in the State Engineers Office. The state code requires that we make a charge for the recording of any document of one dollar for the first one hundred words and \$.15 for each additional one hundred words or fraction thereof. If it is your desire to have the document recorded, kindly so inform this office and remit the necessary fee and the matter will be promptly taken care of.

Very truly yours,

Dean E. Loucks
State Engineer

DWL/ed

ADDRESS ONLY THE REGIONAL DIRECTOR
FISH AND WILDLIFE SERVICE
AND REFER TO

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

OFFICE OF REGIONAL DIRECTOR

818 PLYMOUTH BUILDING
MINNEAPOLIS 2, MINNESOTA
February 4, 1948

REGION 3

NORTH DAKOTA
SOUTH DAKOTA
NEBRASKA
MINNESOTA
IOWA
MISSOURI
WISCONSIN
MICHIGAN
ILLINOIS
INDIANA

Office of State Engineer
Dean W. Loucks, State Engineer
Pierre, South Dakota

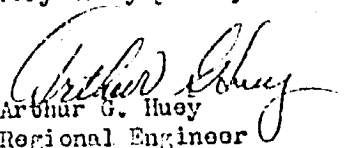
Re: Lake Andes Water
Permit No. U.S. 517

Dear Mr. Loucks:

Reference is made to your Letter of Authorization for the inspection report to be made by Robert W. Dougall on the Lake Andes Migratory Waterfowl Refuge, Charles Mix County, South Dakota, dated May 15, 1942 for the water appropriation to the United States of America under withdrawal No. U. S. 517.

Attached hereto please find a Certificate of Examination of Works as prepared by the Examining Engineer, R. W. Dougall. We are of the opinion that the above Certificate of Examination of Works completes the necessary certificates and documents for your file in order that you will be in a position to provide this office with a Certificate of Construction of Works and Appropriation for the withdrawal of water from further appropriations of waters of Lake Andes and tributary creeks as provided for under withdrawal No. U. S. 517. Should it be necessary to file further certificates or documents prior to the issuance of Certificate of Construction of Works and Appropriation, please advise this office in order that we may submit all necessary reports in order that the final certificate may be received.

Very truly yours,


Arthur G. Huey
Regional Engineer

CC - Dougall, Minot, N. Dak.
Enclosures.

**SOUTH DIKE AND NORTH DIKE
LAKE ANDES NATIONAL WILDLIFE REFUGE
CHARLES MIX COUNTY, SOUTH DAKOTA**

INSPECTION: September 14, 2006

W. W. Wheeler and Associates, Inc.

Water Resources Engineers

3700 South Inca Street, Englewood, CO 80110
Phone (303) 761-4130 Fax (303) 761-2802

TECHNICAL MEMORANDUM

DATE: March 2, 2007

TO: Brad Iarossi, P.E., U.S. Fish & Wildlife Service (FWS),
Service Dam Safety Officer
Don Fazzan, P.E., FWS Region 6 Dam Safety Officer
Mike Bryant, Refuge Manager, Lake Andes National Wildlife Refuge
Kit Choi, Ph.D., P.E., BasePoint Design Corporation

FROM: Steve Jamieson, P.E., W. W. Wheeler and Associates, Inc. (Wheeler) 
Don Lopez, P.E., (Wheeler)
Matt Loose, P.E., (Wheeler)

SUBJECT: Documentation of South Dike and North Dike Inspections,
Lake Andes National Wildlife Refuge, Charles Mix County, South Dakota,
Subcontract No. 04CA810941-2, Delivery Order 982106X04141,
Wheeler Project No. 1636.03.04

This memorandum summarizes Wheeler's inspections of the North Dike and South Dike road crossings located on Lake Andes National Wildlife Refuge (Refuge). Don Lopez and Matt Loose inspected South Dike and North Dike on September 14, 2006. The purpose of the visit to the Refuge was to perform the initial Safety Evaluation of Existing Dams (SEED) inspection of South Dike. After completing our field observations and discussions with Refuge personnel, it was clear that there are actually three embankments at Lake Andes. A summary of these three embankments is provided in Table 1. It is Wheeler's opinion that none of these embankments should be considered as dams in the FWS national dam inventory.

BACKGROUND

Lake Andes is located in a large, natural "pothole" depression. The lake itself is generally lower in elevation than the surrounding land. Water in Lake Andes may flow from north to south or from south to north in the lake, depending on the location of runoff into the lake. The location of Lake Andes is shown on the attached project location, vicinity, and area maps as well as on the cover of the Federal Highway Administration (FHA) drawings provided in the General Appendix. In this memorandum, the upstream end refers to the North end of Lake Andes and the downstream end refers to the South end of Lake Andes.

Three embankments cross the lake in a general East-West direction. Key information about each embankment is summarized in Table 1.

Table 1 – Summary of Key Lake Andes Embankment Information

Embankment	Local Road Name	Approximate Length at Lake Andes	Ownership
North Dike	288 th Street	2,700 feet	FWS
South Dike	291 th Street	3,750 feet	FWS
Highway 50	U.S. Highways 18, 50, and 281	1,250 feet	FHA

The area of Lake Andes north of the North Dike is known as the North Unit. The area of Lake Andes between the North and South Dike is known as the Center Unit. The area between the South Dike and Highway 50 is known as the South Unit. These units are shown on the schematic profile provided on Figure 1.

LAND OWNERSHIP

During our site visit, Mike Bryant, Refuge Manager, explained the ownership of the embankments and the lake is as follows:

1. FWS does not own Highway 50, including the culverts and stop logs that cross under the highway.
2. FWS does not own Lake Andes, but owns an easement to provide wildlife habitat at the Lake Andes normal high water line (NHWL), which is set by the top of the Highway 50 culvert stop logs at Elevation 1438.25¹.
3. FWS has negotiated flood easements with local property owners for 2.0 feet above the NHWL.
4. FWS owns both the North Dike and South Dike embankments where they cross Lake Andes.

HIGHWAY 50 CULVERT

A culvert crossing under State Highway 50 is located on the downstream (southern) end of Lake Andes. This crossing consists of two box culvert bays that are 10 feet wide by 10 feet tall. Stop logs are located at the entrance to each bay up to Elevation 1438.25. The culvert dimensions are indicated on the South Dakota Department of Transportation drawing provided in the General Appendix. A picture of the Highway 50 culvert is provided on Photo 1.

¹ All Elevations are reported in feet above the national Geodetic Vertical Datum

Approximately 60 feet upstream of the culvert is a wooden bridge that passes over an old railroad grade (presently a bike path). This bridge is shown on Photo 2. According to our measurements during our inspection, the ground surface beneath the bridge is at Elevation 1435.05, which is approximately 3.2 feet lower than the top of the culvert stop logs. During our inspection, the Lake Andes water surface was located several hundred feet downstream of the bridge opening due to dry conditions. The Highway 50 culvert stop logs have created a small pond between the stop logs and the old railroad bridge.

The Highway 50 stop logs can control water in Lake Andes from Elevation 1435.05 to the NHWL elevation of 1438.25. Below Elevation 1435.05, Lake Andes is confined to its natural "pothole" area upstream of the railroad/bike path bridge opening.

It is our opinion that the Highway 50 Culvert embankment should not be considered as a FWS dam because it is owned and operated by the South Dakota Department of Transportation and the FWS does not control the elevation of the stop logs at this structure.

NORTH DIKE AND SOUTH DIKE WIDENING PROJECT

South Dike and North Dike are shown on the attached project vicinity and area maps. These embankments are owned and maintained by the FWS as cross dikes to allow access across Lake Andes. The FHA has designed a project to widen the North Dike and South Dike roadways. As part of this project, the FHA will replace the existing dikes and culvert crossings with new culverts constructed to the same dimensions and elevations of the existing culverts. We understand construction is scheduled for 2007. Our review of this project was based on the FHA's "99% review" plans provided to us by the Refuge. Key drawings from this plan set are provided on the General Appendix.

NORTH DIKE

North Dike is a road crossing approximately 14 feet high, with a 20-foot-wide crest, and 2,700 feet long. Water passes under the road at 8 culvert locations. Seven of the culverts are 48-inch-diameter pipe conduits with no controls, so the water surface would be at the same elevation on both sides of the dike. The FHA drawings indicate that these culverts would be replaced with similar 48-inch-diameter uncontrolled pipe conduits.

The remaining structure is a reinforced concrete box culvert that has an opening 20 feet wide by 8 feet high and has a deteriorated stop log bay at the upstream end. The box culvert is shown on Photo 3. The culvert invert was measured by hand level during our inspection to be at about Elevation 1430.5. The replacement box culvert will have an opening 30 feet wide by 7 feet high, as indicated in the drawings provided in the general appendix. The FHA will locate the replacement culvert at an invert elevation of approximately 1432.8.

Stop logs in the existing structure are placed 6 feet above the upstream invert of the culvert, or two feet below the culvert crown, at Elevation 1436.5. The FHA drawings indicate that the replacement structure will have stop log support 6.0 feet above the culvert invert at Elevation 1438.8. The top of the proposed stop log supports would then be approximately 0.55 foot above the NHWL (Elevation 1438.25).

During our inspection, we measured accumulated silt deposits up to 2.8 feet below the culvert crown, and the downstream end contains silt deposits up to 3.3 feet below the culvert crown. In other words, sedimentation is approximately 5.2 feet above the culvert invert on the upstream end and approximately 4.7 feet above the culvert invert on the downstream end.

SOUTH DIKE

South Dike is also a road crossing that is approximately 14 feet high, with a 20 foot wide crest, and 3,750 feet long. South Dike does not have uncontrolled conduits such as described for North Dike. Water passes under the road through a reinforced concrete box culvert shown on Photo 4. This structure is constructed to the same dimensions as the existing North Dike box culvert. The existing structure is also similar to the proposed FHA replacement structure that is shown on the drawings provided in the general support appendix. Both the existing and the proposed culverts have a total opening 20 feet wide by 8 feet high. The existing culvert inlet was measured to be at Elevation 1429.0. Based on the enclosed FHA plans, the replacement culvert will be raised to an invert elevation of approximately Elevation 1432.2.

Stop logs are placed 6 feet above the downstream invert of the existing culvert, or two feet below the culvert crown, at Elevation 1435.0. These structures were observed to be silted in. Plans for the replacement culvert also indicate that the stop logs supports will be constructed 6.0 feet above the culvert invert at Elevation 1438.2, which is near the NHWL of 1438.25.

The upstream end of the existing culvert has accumulated silt deposits up to 1.0 foot below the culvert crown, and the downstream end contains silt deposits up to 2.0 feet below the culvert crown. In other words, sediments are approximately 7.0 feet above the culvert invert on the upstream end and approximately 6.0 feet above the culvert invert on the downstream end.

EVALUATIONS

Lake Andes is a prairie lake formed by a natural low spot in the terrain. There is not a defined tributary stream or other water source for the lake. The Lake is formed by surface runoff from the surrounding terrain resulting from precipitation events. The lake drains through a low spot at about Elevation 1435 on the reservoir rim, located under the old railroad bridge just upstream of the Highway 50 culvert. The Highway 50 stop logs serve as a saddle dike on the reservoir rim to allow an additional 3.2 feet of impoundment above the natural lake impoundment. At water surfaces below Elevation 1435, there is no natural discharge channel for the lake, and Lake Andes will only loose

water due to evaporation. Mr. Bryant indicated that the natural cycle for the lake is that it forms during wet years and slowly evaporates during dry years, and periodically goes completely dry before filling up again.

During our inspection, Mr. Bryant indicated that, since construction of the North and South Dikes (1941 through 1942), the Refuge has never operated the box culvert stop logs with the intent of controlling water levels in the three units of the lake. The lack of stop log operation is evidenced by the extensive sedimentation upstream and downstream of the stop logs. However, we understand that the Refuge desires to have the ability to manipulate water levels in Lake Andes with the new stop log structures that have been designed by the FHA.

The FWS dam safety definitions clearly state that "an interior dike or cross dike located within an impoundment or levee" is not considered to be an inventory dam. Further, due to the level of siltation on either side of the North Dike and South Dike box culverts, the height of these structures is well below six feet. As a result, it is Wheeler's opinion that the existing South Dike and North Dike embankments should not be considered as an Inventory Dams.

CONCLUSIONS AND RECOMMENDATIONS

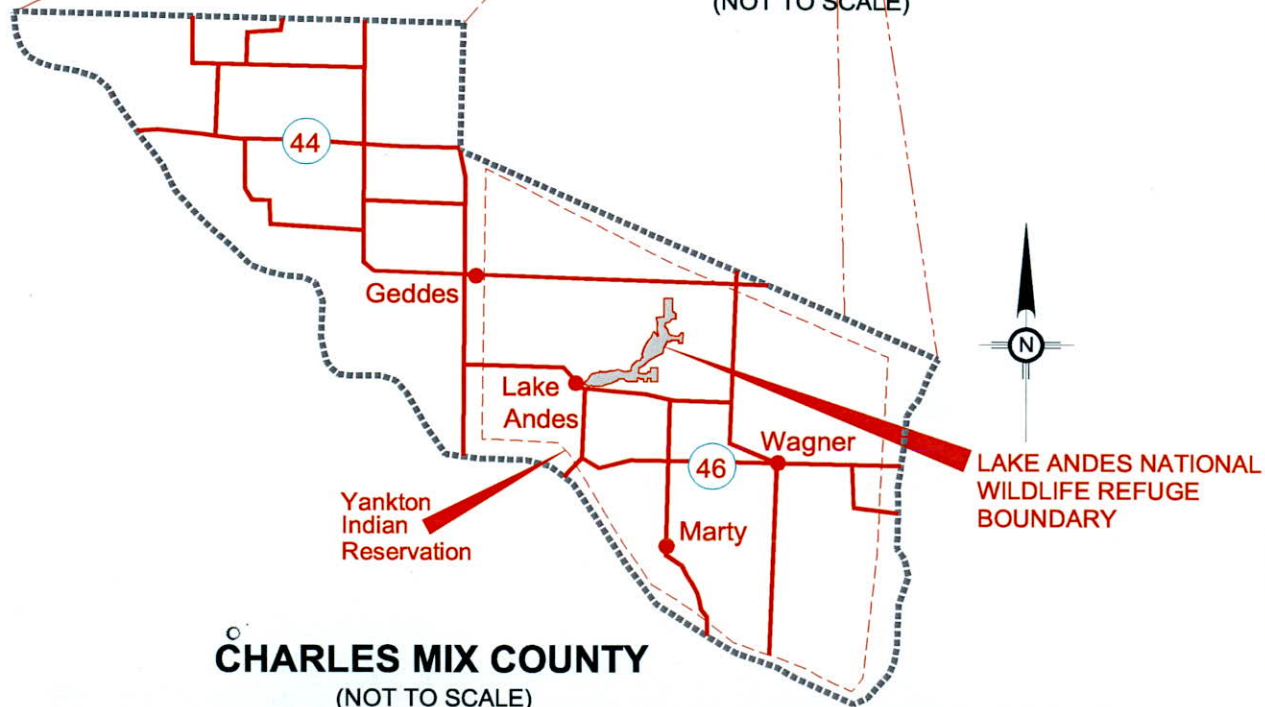
Based on our review of the FHA drawings that were provided to us, we believe that the reconstructed North Dike and South Dike embankments should also be considered to be Noninventory Dams because these structures would continue to function as interior cross dikes located within an existing impoundment. The maximum controllable water height above the discharge channel from the lake is 3.2 feet. Above the top of the stop logs the lake will equalize on both sides of either North or South Dike before inundating the dikes. The top elevations of the proposed stop log bays are at an elevation that is near to the top of the stop logs under Highway 50. If one of these stop log structures failed under the maximum differential water storage height, the large reservoir pool is expected to be equalized at or below the normal high water line elevation of Lake Andes.

We did not perform a dam safety evaluation of the Highway 50 culvert and stop log structure as it not owned, operated, or maintained by the FWS.

MAPS



STATE of SOUTH DAKOTA
(NOT TO SCALE)



U.S.
FISH & WILDLIFE
SERVICE



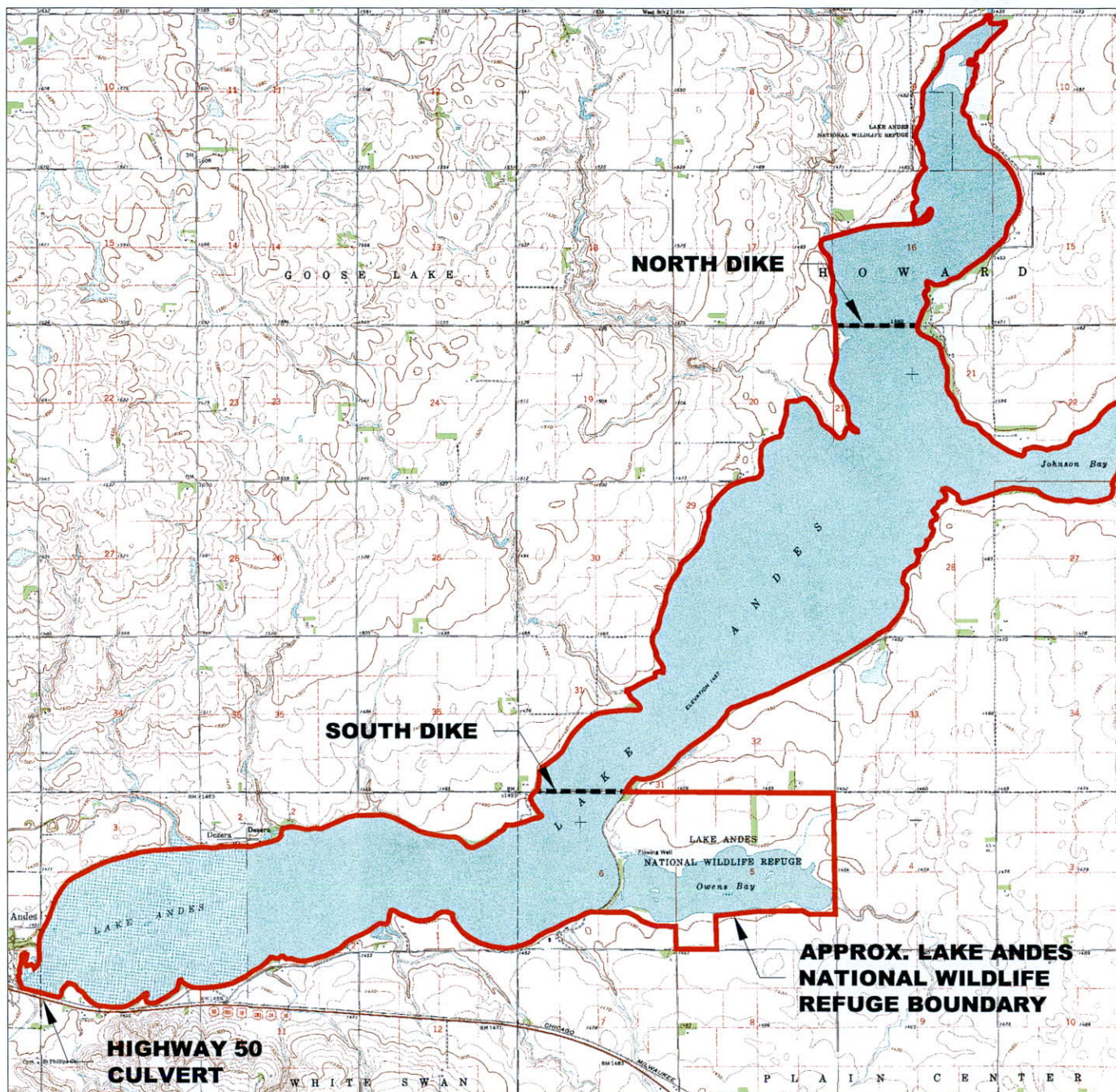
PROJECT VICINITY MAP
SOUTH DIKE
LAKE ANDES N.W.R.
CHARLES MIX COUNTY,
SOUTH DAKOTA



U.S.
FISH & WILDLIFE
SERVICE



PROJECT LOCATION MAP
SOUTH DIKE
LAKE ANDES N.W.R.
CHARLES MIX COUNTY,
SOUTH DAKOTA



U.S.
FISH & WILDLIFE
SERVICE



PROJECT AREA MAP
SOUTH DIKE
LAKE ANDES N.W.R.
CHARLES MIX COUNTY,
SOUTH DAKOTA

PHOTOGRAPHS

LAKE ANDES NATIONAL WILDLIFE REFUGE
South and North Dike
2006 NID Assessment
September 14, 2006



Photo 1: View of the Highway 50 Culvert from Lake Andes.



Photo 2: View of the old railroad bridge and bike path upstream of the Highway 50 culvert.

LAKE ANDES NATIONAL WILDLIFE REFUGE
South and North Dike
2006 NID Assessment
September 14, 2006

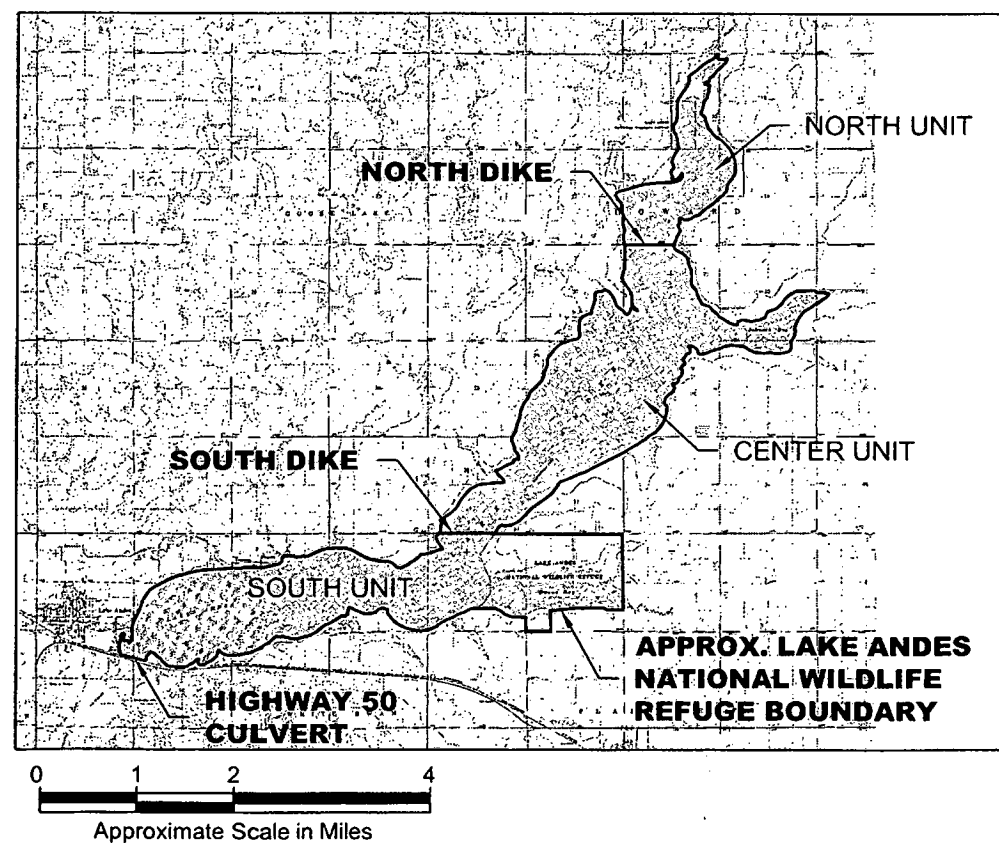
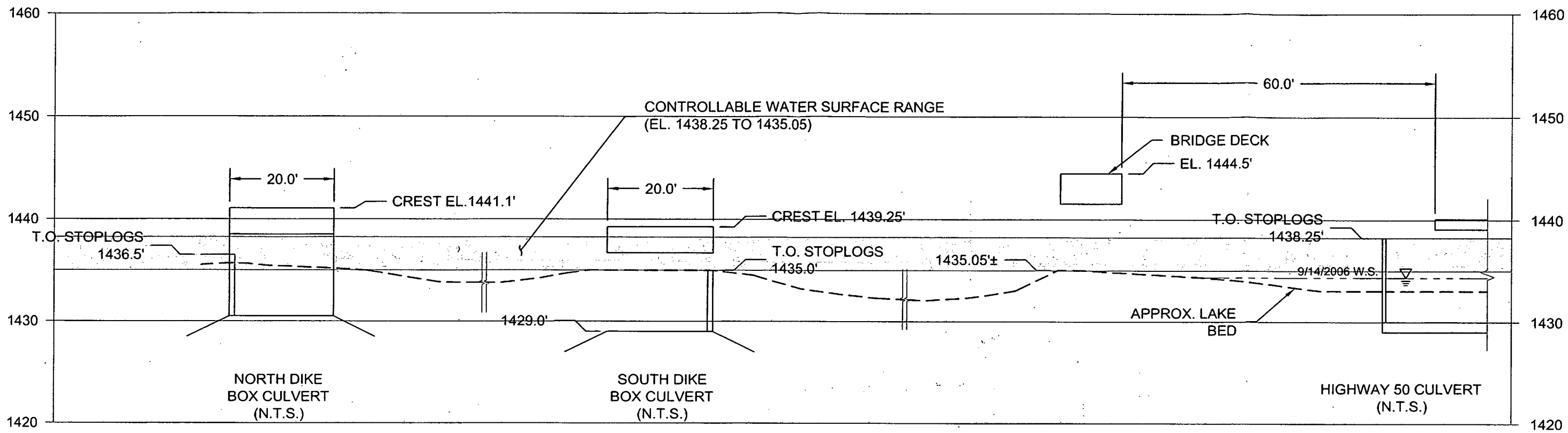


Photo 3: View of the upstream side of the North Dike bridge crossing.



Photo 4: View of the upstream side of the South Dike bridge crossing.

FIGURES



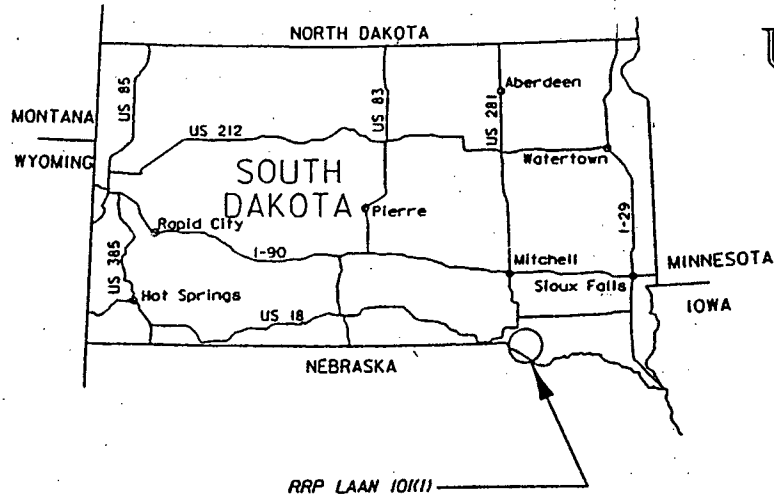
NOTE:
 1. THE ELEVATIONS SHOWN ARE BASED ON HAND LEVEL MEASUREMENTS BY W. W. WHEELER AND ASSOCIATES, INC. ON 9/14/06.

February 2007	W. W. Wheeler and Associates, Inc. Water Resources Engineers	
	Lake Andes NWR Schematic Profile of the North and South Dike	
	Job Number 1636.03.04	Figure 1

DRAWINGS

REG	STATE	PROJECT	SHEET NO.	TOTAL SHEETS
6	SD	RRP LAAN 101(1) NORTH & SOUTH DIKES	A1	A4

INDEX TO SHEETS	
SHEET	DESCRIPTION
A1	TITLE SHEET
A2	CONVENTIONAL PLAN SYMBOLS AND ABBREVIATIONS
A3	TYPICAL SECTIONS
A4	SITE MAP
B1	SUMMARY OF QUANTITIES
B2	DRAINAGE SUMMARY
B3-B4	TABULATION OF QUANTITIES
B5	GRADING SUMMARY
B6	MASS HAUL DIAGRAMS
B7	CONTROL POINT COORDINATE SUMMARY
C1-C5	PLAN AND PROFILES
D1	ROAD CONNECTIONS
E1-E2	EROSION CONTROL DETAILS
F1	BOX CULVERT FILL CROSS SECTIONS
G1-G3	MITIGATION, IRRIGATION CONTROL STRUCTURE
H1-H4	GUARDRAIL DETAILS
J1-J4	PIPE CULVERT DETAILS
S1-S3	BOX CULVERT DETAILS
T1-T2	PERMANENT TRAFFIC CONTROL DETAILS
T3-T5	TEMPORARY TRAFFIC CONTROL DETAILS
X1-X19	SOUTH CROSS SECTIONS
Y1-Y14	NORTH CROSS SECTIONS
Z1-Z3	PIPE CULVERT CROSS SECTIONS



KEY MAP OF SO. DAKOTA

U.S. DEPARTMENT OF INTERIOR FISH AND WILDLIFE SERVICE LAKE ANDES N.W.R.

PLANS FOR PROPOSED
SOUTH DAKOTA RRP LAAN 101(1)
NORTH AND SOUTH DIKES
CHARLES MIX COUNTY
LENGTH 1.22 MILES

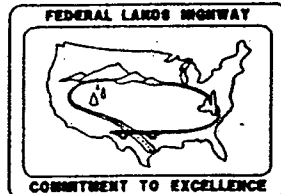
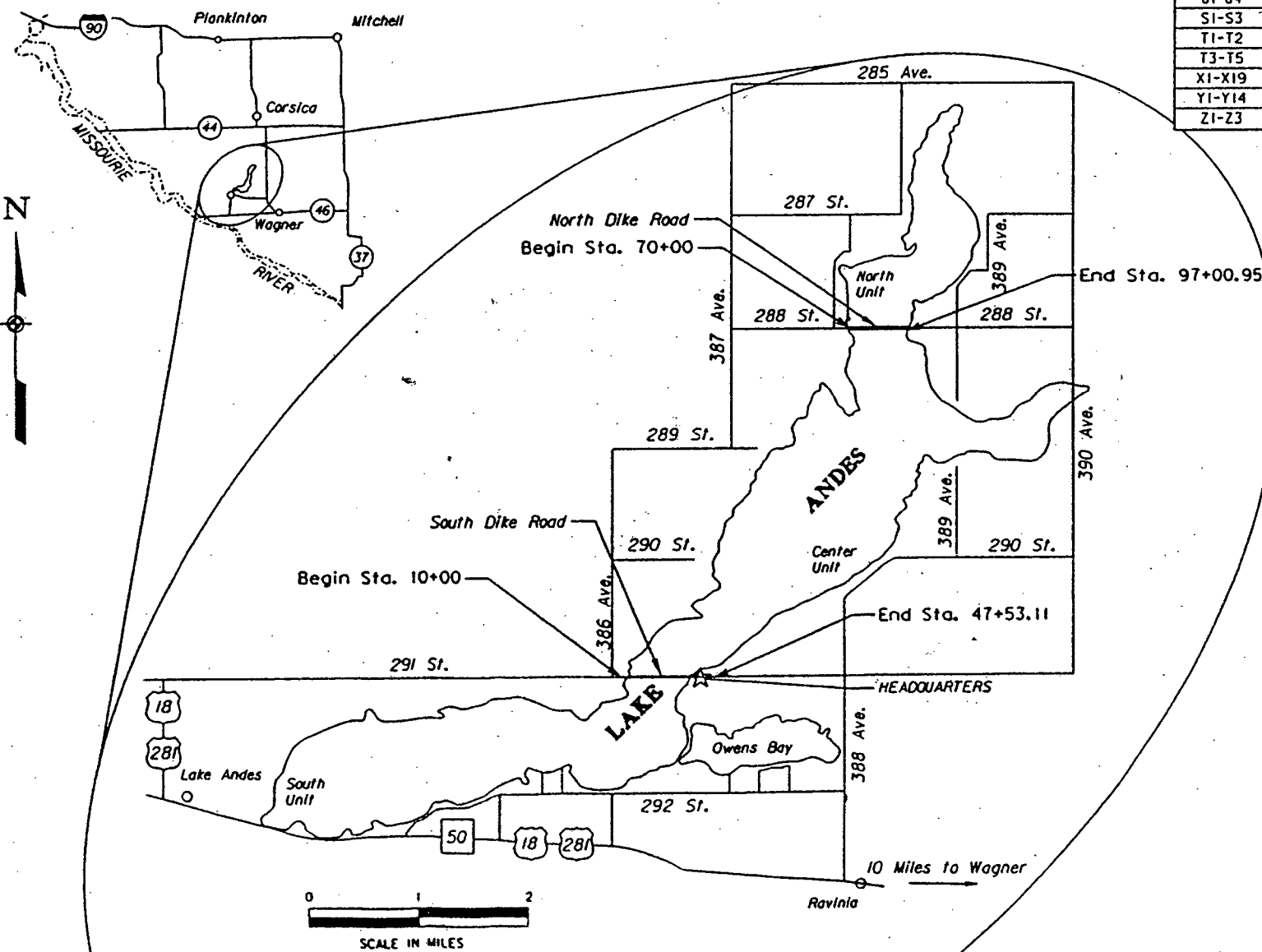
TYPE OF CONSTRUCTION:
Embankment construction,
drainage structures, and
aggregate surface course

DESIGN DESIGNATIONS:

ADT (2004)	100
SADT (2025)	280
D	50%
T	25%
V	35 MPH
e(max)	6%

PLANS PREPARED BY
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
CENTRAL FEDERAL LANDS HIGHWAY DIVISION
DENVER, COLORADO
June, 2006

PROJECT MANAGER	LEAD DESIGNER
R. GATSAUER	L. DUTER



PRELIMINARY
Recommended
Division Engineer
Central Federal Lands Highway Division
Approved
Project Leader
Lake Andes National Wildlife Refuge
DATE 2006
DATE 2006
NOT FOR CONSTRUCTION

PAGE 2



Q_d	331 ds
Q_F	331 ds
Q_{mn}	455 ds

STA. 39+00.00
OVER LAKE ANDES OUTLET
STR. NO. 12-389-243
PCEMS NO. 4699

0° SKEW
SEC. 9-T96N-R65W
P 0018(109)339
HS 20-44
(& ALT.)

PRELIMINARY LAYOUT
FOR
10' X 10' BOX CULVERT

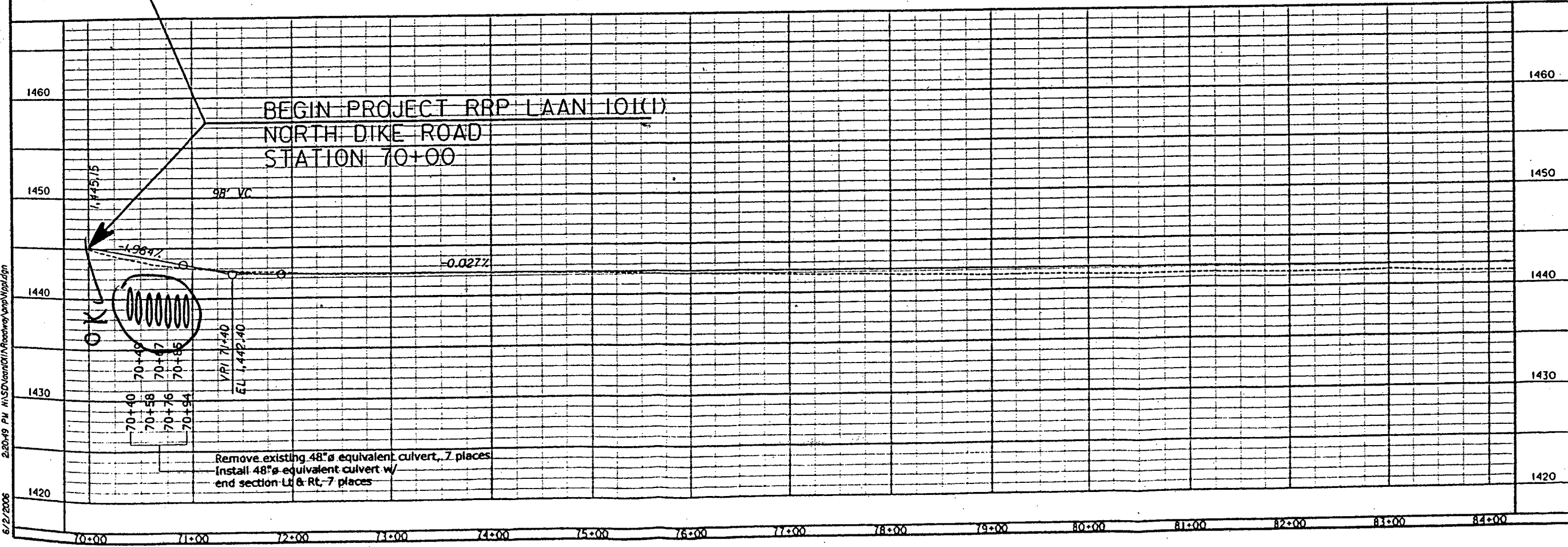
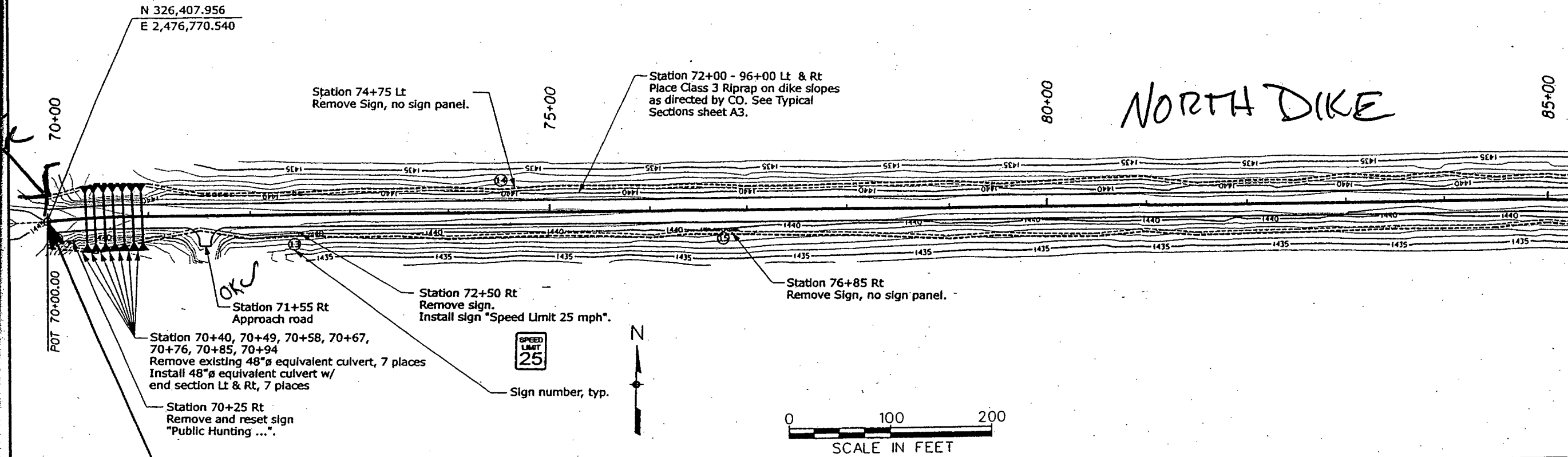
CHARLES MIX COUNTY
DEPT. OF TRANSPORTATION
JULY 2003 (1)

-X028-

PLANS BY :
OFFICE OF BRIDGE DESIGN, SOUTH DAKOTA DEPARTMENT OF TRANSPORTATION

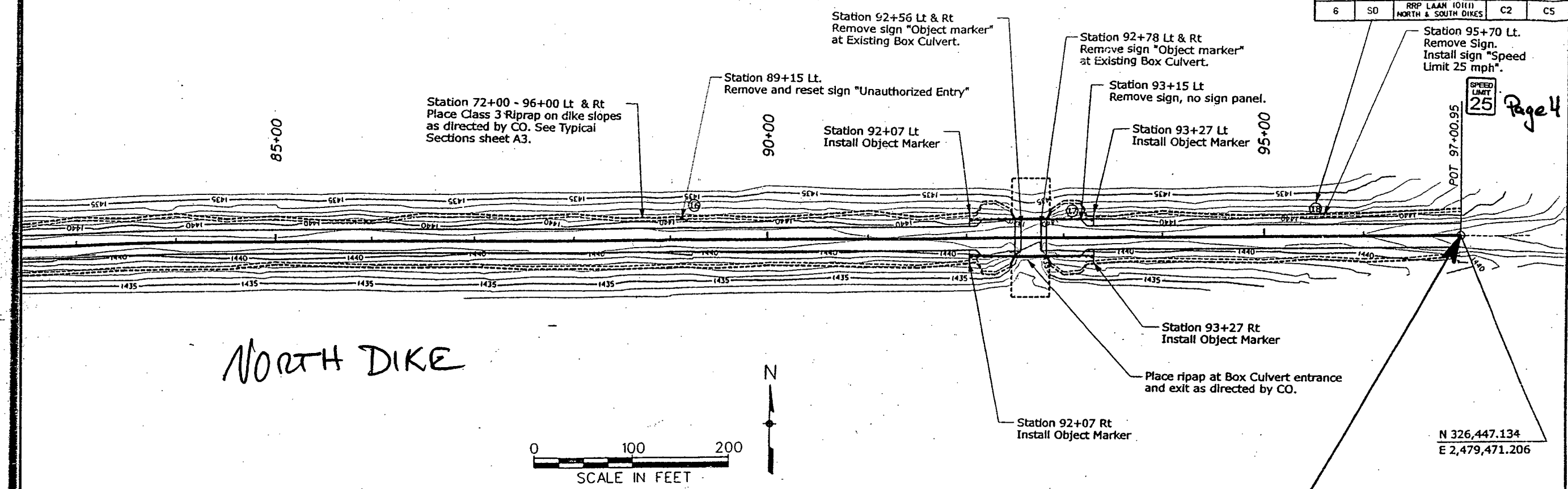
DESIGNED BY SJ CMIX4699	DRAWN BY SJ 4499RACI	CHECKED BY AV	APPROVED <i>[Signature]</i> BRUCE ENGINEER
-------------------------------	----------------------------	------------------	--

FENCE
COUNTER
@ STA
0+00

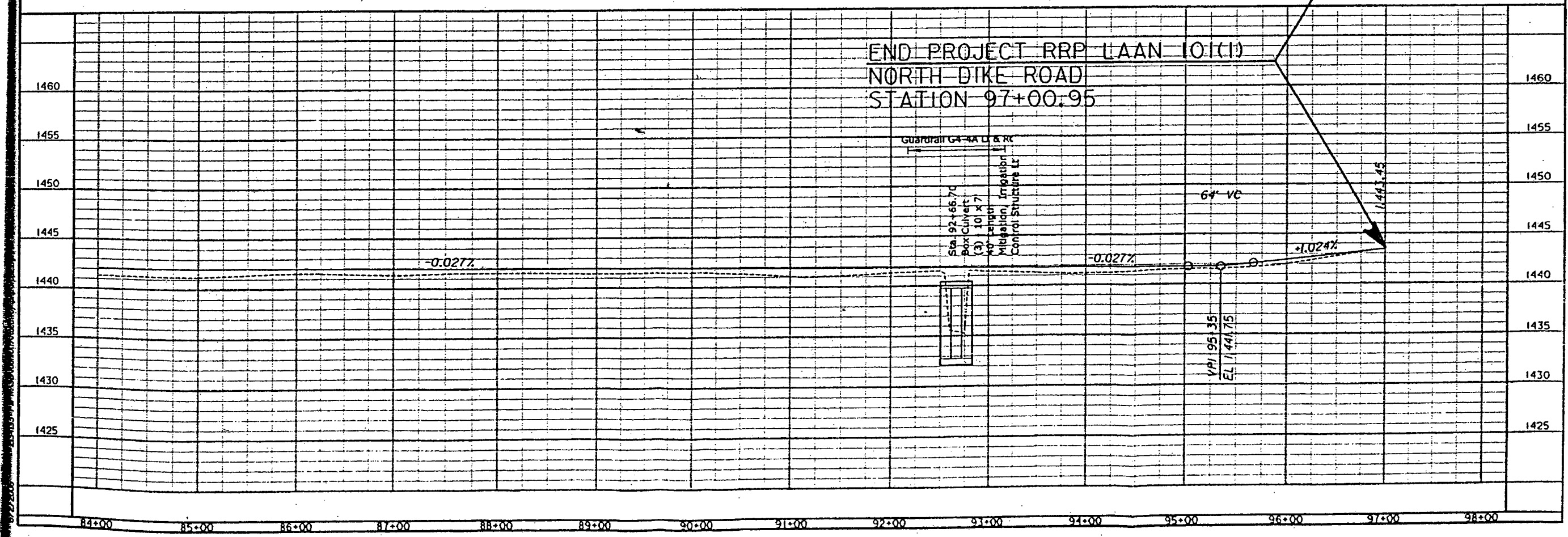
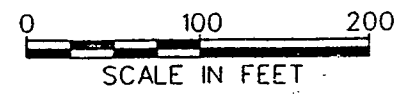


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6	SD	RRP LAAN 101(1) NORTH & SOUTH DIKES	C2	C5



NORTH DIKE

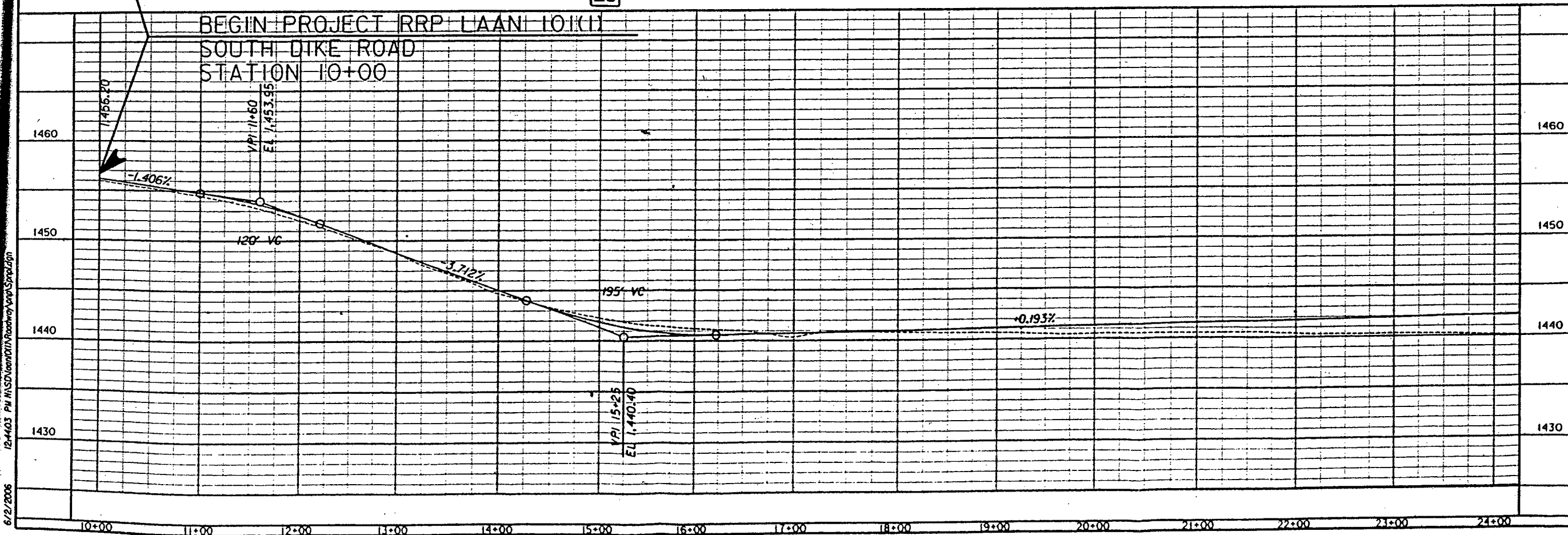
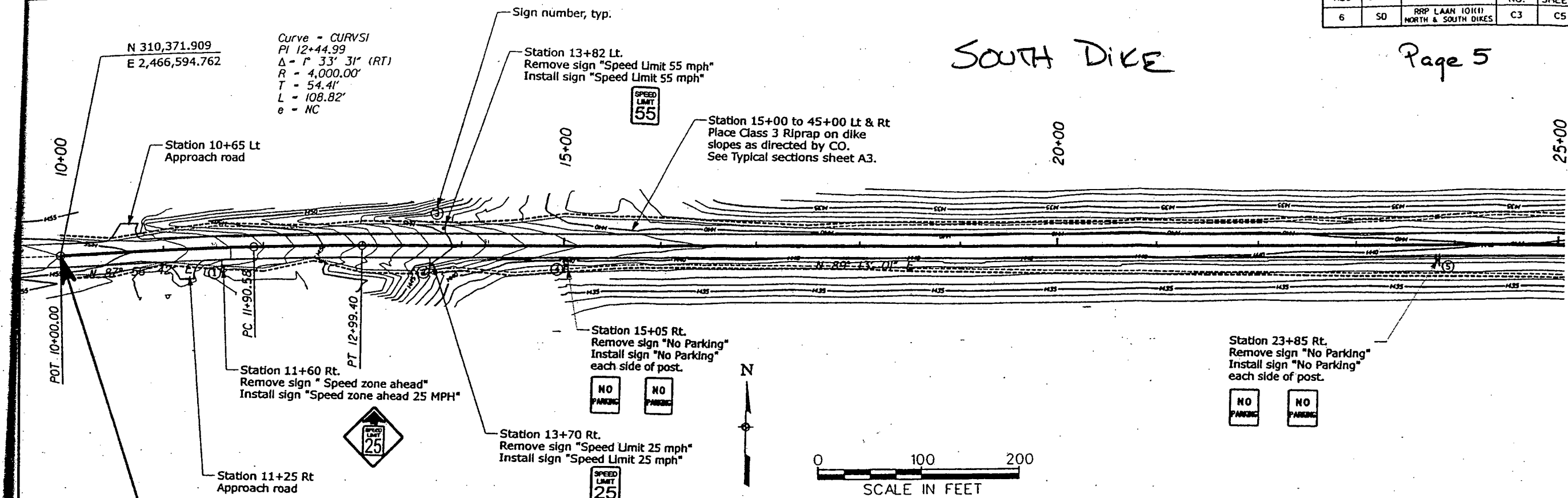


END PROJECT RRP LAAN 101(1)
NORTH DIKE ROAD
STATION 97+00.95

Page 4

REG	STATE	PROJECT	SHEET NO.	TOTAL SHEETS
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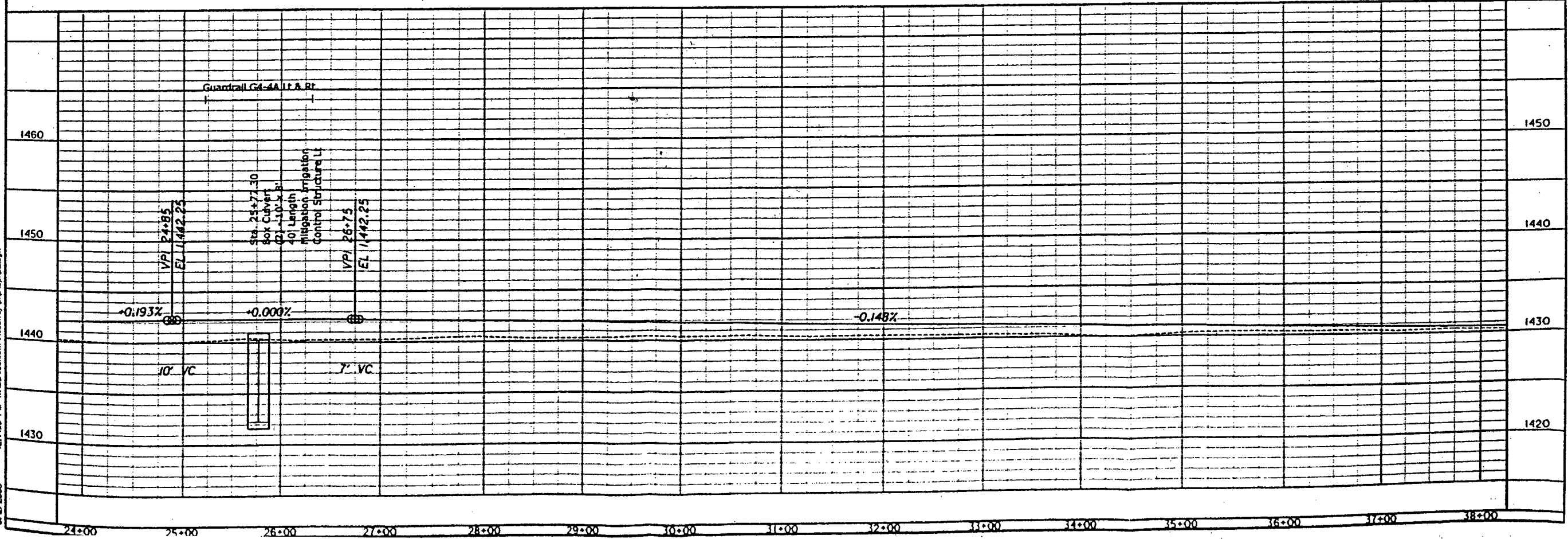
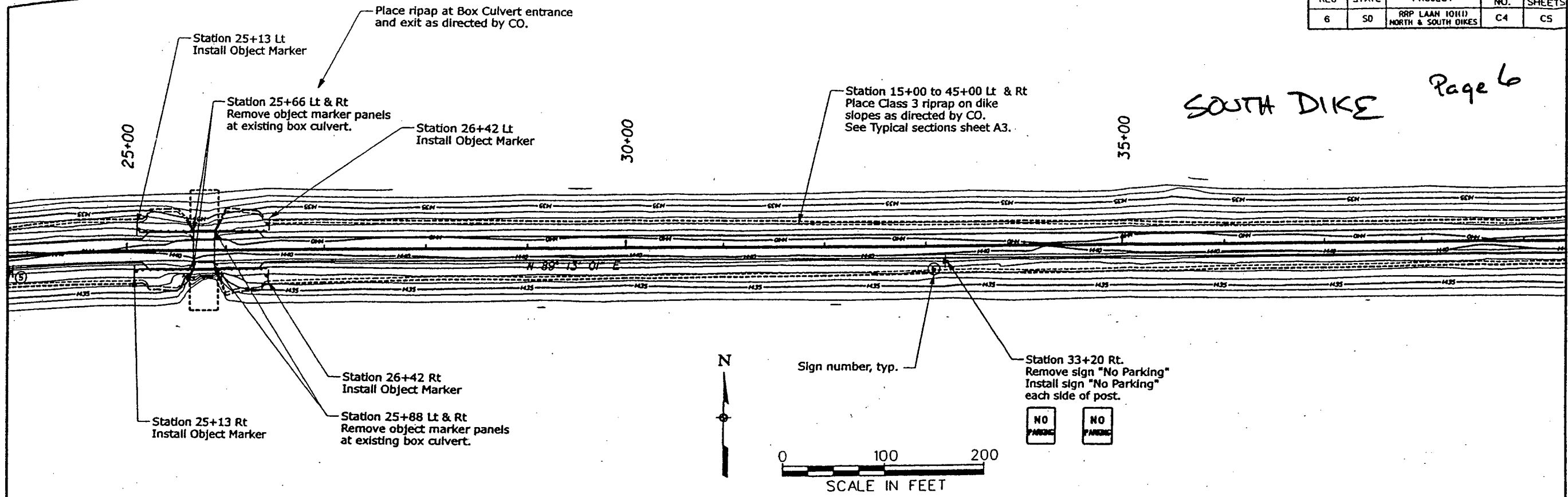
Page 5



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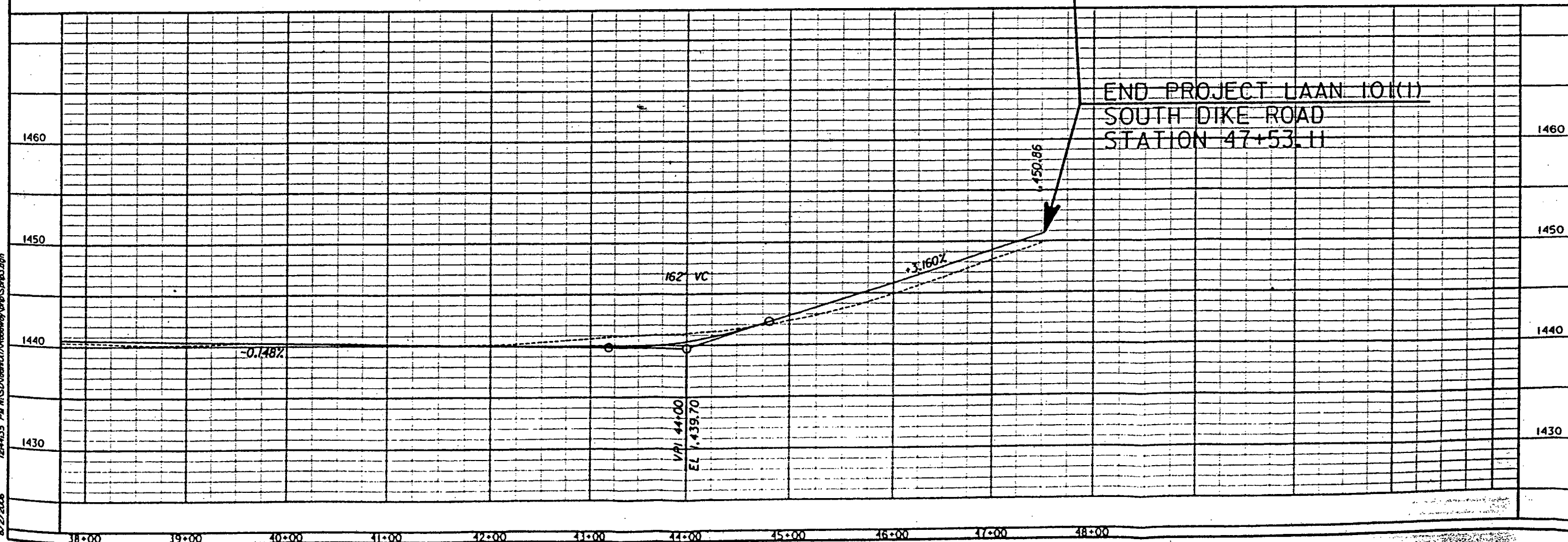
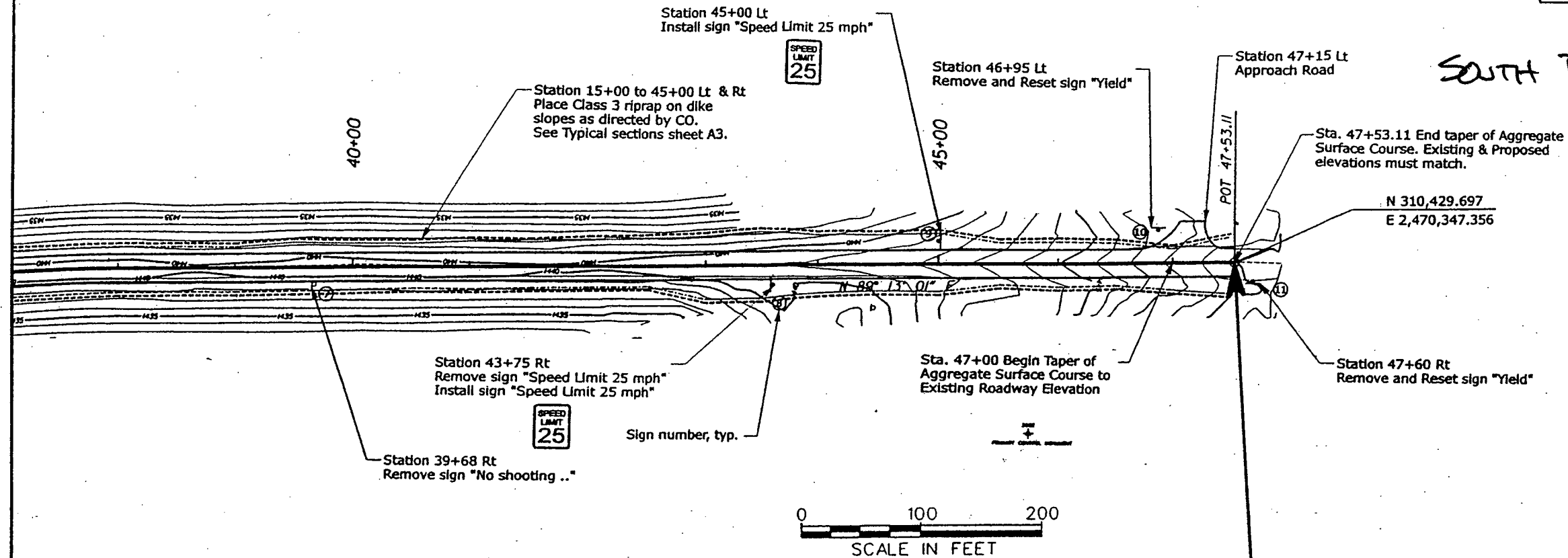
SOUTH DIKE Page 6



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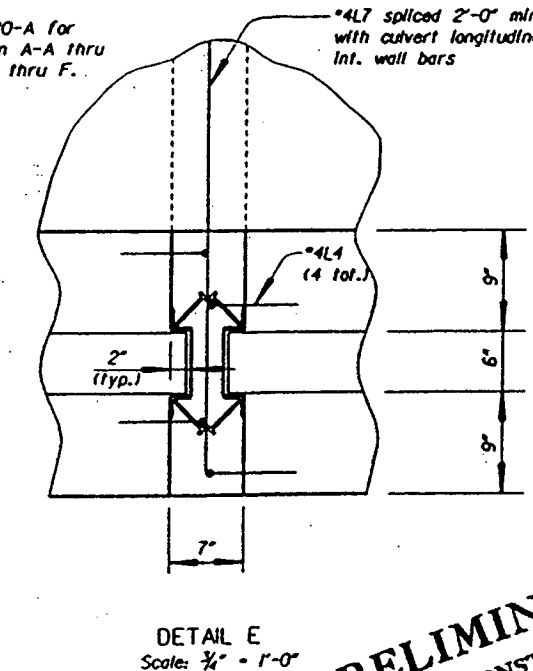
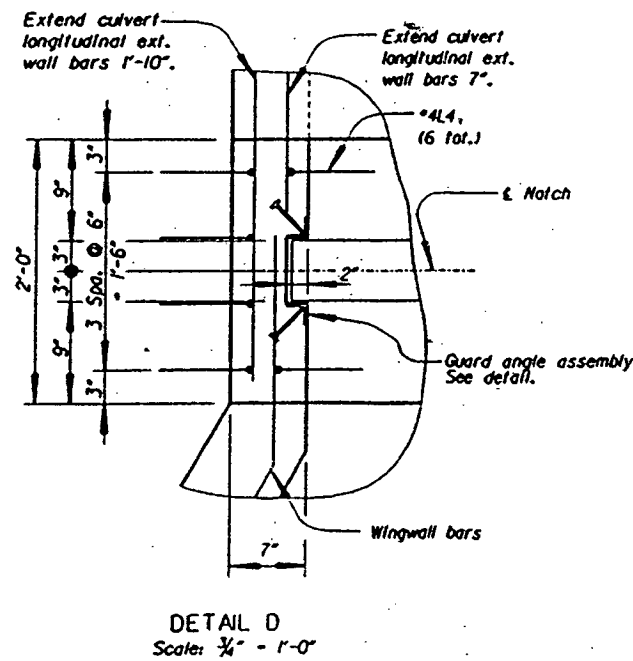
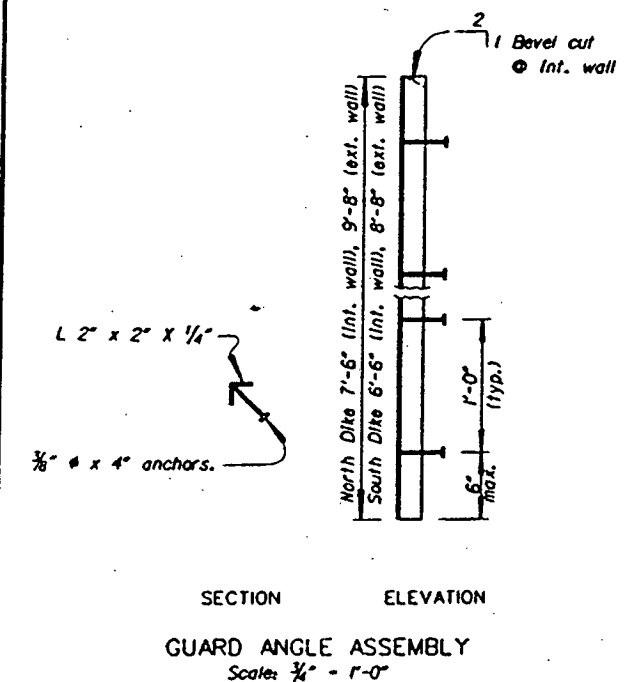
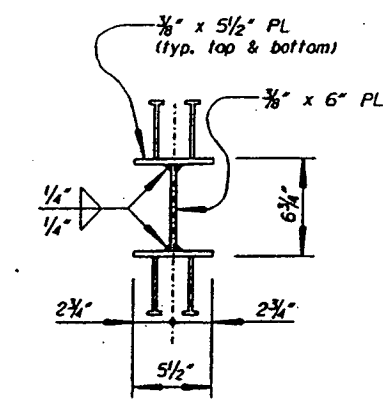
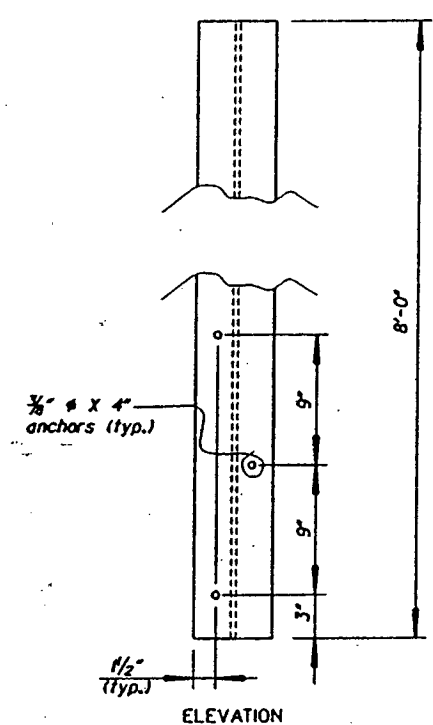
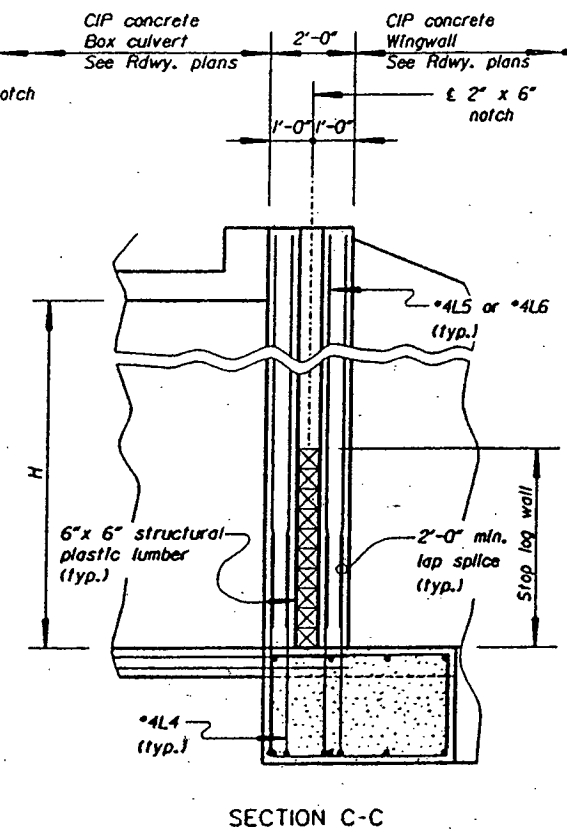
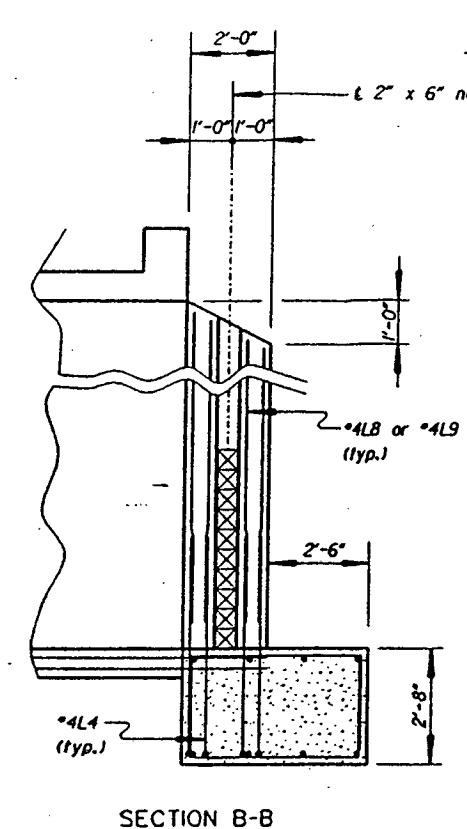
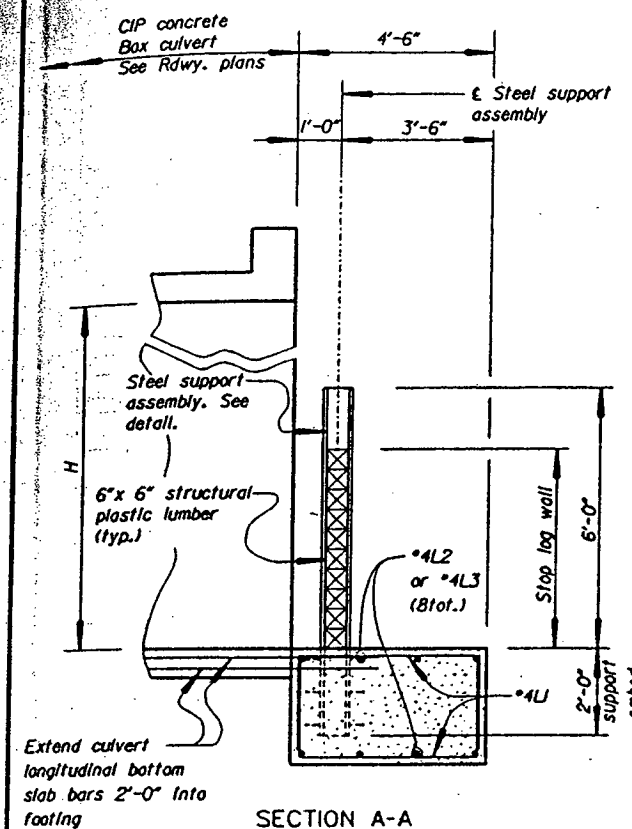
SOUTH DIKE
Page 7



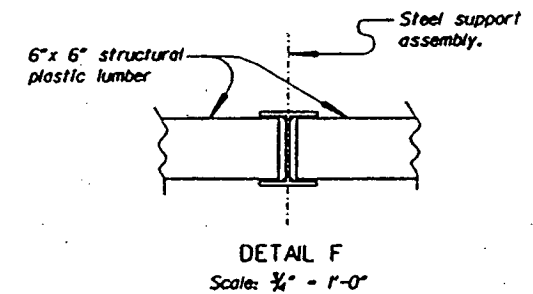
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6/2/2006

REGION	STATE	PROJECT	SHEET NO.	TOTAL SHEETS
6	SD	RRP LAAN 101(1) NORTH AND SOUTH DIKE	G2	G3

Page 9



STEEL SUPPORT ASSEMBLY DETAIL
(2 Req'd @ North dike)
(3 Req'd @ South dike)
Scale: 1" = 1'-0"



U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
CENTRAL FEDERAL LANDS HIGHWAY DIVISION
LAKE ANDES NATIONAL WILDLIFE REFUGE
N. & S. DIKE STOP LOG STRUCTURE
CHARLES MIX COUNTY, SOUTH DAKOTA

MISCELLANEOUS DETAILS

PRELIMINARY
NOT FOR CONSTRUCTION

6/2/2006
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NO.	DATE	BY	REVISIONS	NO.	DATE	BY	REVISIONS	DESIGNED BY	DRAWN BY	CHECKED BY	SCALE	PROJECT TEAM LEADER	BRIDGE DRAWING	DATE	DRAWING NO.
								KARL EIKERMANN	RICKY WIPF	BENN OLTMANN	1/4" = 1'-0"	KARL EIKERMANN	2 of 3	MARCH 2006	RG2820-B