

9953

Diagram No. LS-9

NOAA FORM 76-35A	
U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION NATIONAL OCEAN SURVEY	
DESCRIPTIVE REPORT	
Type of Survey	Hydrographic
Field No.	WH-5-1-81
Office No.	H-9953
LOCALITY	
State	Wisconsin—Minnesota
General Locality	Lake Superior
Locality	Duluth Harbor Basin to East Gate Basin
1981	
CHIEF OF PARTY CDR F.P. Rossi	
LIBRARY & ARCHIVES	
DATE	November 21, 1985

9953

HYDROGRAPHIC TITLE SHEET

H-9953

INSTRUCTIONS - The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

FIELD NO.

WH-5-1-81

WISCONSIN --

State Minnesota

General locality Lake Superior

Locality Duluth Harbor Basin to East Gate Basin

Scale 1:5000 Date of survey 27 May to 13 October 1981

Instructions dated 12 February 1981 Project No. OPR 2137-WH-81

Vessel WHITING launches 1014, 1015, and MonArk

Chief of party CDR Frank P. Rossi, Commanding Officer

Surveyed by W. Dewhurst, D. Howard, D. Bland, J. Zabitchuck, E. Steigerwald, P. Ruiz, L. Noyes

Soundings taken by echo sounder, hand lead, ~~pole~~ Ross Model 5000 and Raytheon Model DE719B fathometers, and hand lead

Graphic record scaled by WHITING personnel

Graphic record checked by WTD, DKH, JZ, DAB, EAS, PJR RWB, LRN

Protracted by _____ Automated plot by Hydroplot

Soundings penciled by _____

Soundings in ~~fathoms~~ feet at ~~M.L.W.~~ ~~M.L.W.~~ I.G.L.D.

REMARKS: All times are Coordinated Universal Time.

STANDARDS CK'D 12-3-85

C. Long

AWOIS / SURF CHM 12/30/86

R.W.W. 3/18/84

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DESCRIPTIVE REPORT
TO ACCOMPANY
HYDROGRAPHIC SURVEY WH-5-1-81 (1:5,000)

A. PROJECT

Hydrographic survey H-9953 was accomplished in accordance with the project instructions dated February 12, 1981, and Amendment No. 1, dated March 31, 1981. ✓

B. AREA SURVEYED

The northern half of Duluth Harbor was surveyed. The survey was subdivided into three (3) parts defined by the following limits: ✓

	<u>Latitude</u>	<u>Longitude</u>
1.	46°46'15"N	092°07'00"W
2.	46°47'30"N	092°05'15"W
3.	46°45'30"N	092°04'00"W
4.	46°44'45"N	092°04'00"W
5.	46°44'45"N	092°06'00"W
6.	46°44'00"N	092°05'45"W
7.	46°44'00"N	092°06'30"W
8.	46°45'15"N	092°06'30"W
9.	46°45'05"N	092°06'07"W

46 48 00

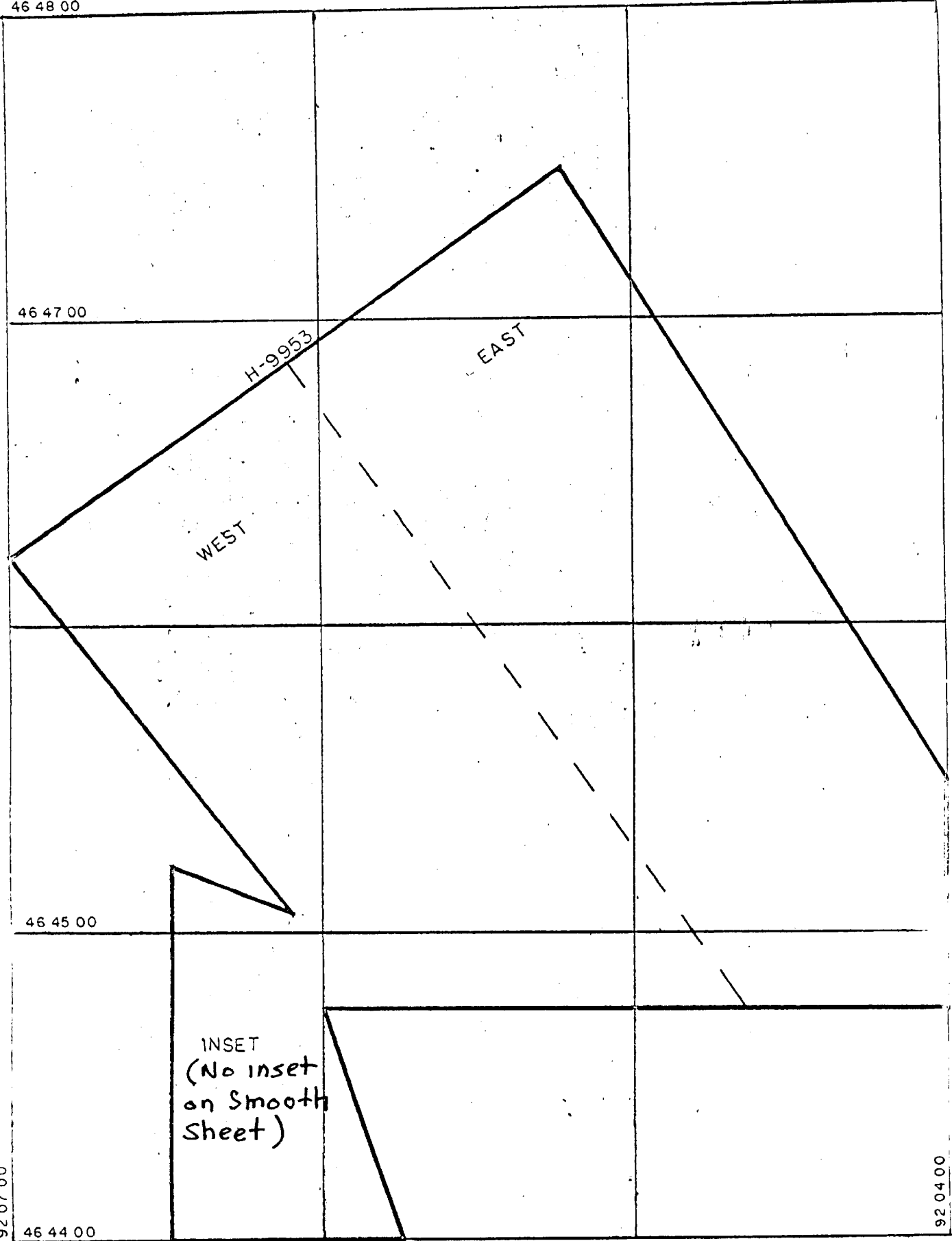
46 47 00

46 45 00

46 44 00

92 07 00

92 04 00



H-9953

WEST

EAST

INSET
(No inset
on Smooth
Sheet)

The Howards Bay inset, was surveyed at the scale of 1:5,000.

The entire sheet was surveyed at 1:5,000, there are no insets on the smooth sheet.

The hydrography was run from May 27 to October 13, 1981, (JD 148 - 286).

Dives were conducted on JD 154 and JD 252. ✓

C. SOUNDING VESSELS

Launches 1014 and 1015, and the WHITING's MonArk were used to complete all of the hydrography on this survey. ✓

<u>Launch</u>	<u>EDP #</u>	<u>Julian Dates Used</u>
1014	2932	148 - 155, 160, 174, 176, 177, 212, 216, & 217.
1015	2931	161 - 163, 165 - 169.
MonArk	2933	178 - 182, 188 - 195, 196, 197, 202, 203, 206, 208, 209, 210, 247, 276, & 286.

The following listing represents the equipment used on each Julian Day:

<u>JD</u>	<u>Launch</u>	<u>S/N</u>	<u>Del Norte</u>			<u>S/N</u>
	<u>EDP #</u>	<u>Fatho</u>	<u>Master</u>	<u>DMU</u>	<u>Remote</u>	<u>T-2</u>
148	2932	1049	1066	180	1137	35052
150	2932	1049	1066	180	1137	35052
151	2932	1049	1066	180	1137	35052
152	2932	1049	1066	180	218	35052

✓
FPS

<u>JD</u>	Launch	S/N	Del Norte			S/N
	<u>EDP #</u>	<u>Fatho</u>	<u>Master</u>	<u>DMU</u>	<u>Remote</u>	<u>T-2</u>
153	2932	1049	1066	180	218	35052
154	2932	1049	1066	180	218	35052
155	2932	1049	1066	180	218	35052
160	2932	1049	1066/273A	180/189	1187/1322	35052
161	2931	1052	246	429	1322	35052
162	2931	1052	246	429	1320	35052
163	2931	1052	273A	189	218	35052
165	2931	1052	273A	189	1322	57484
166	2931	1052	273A	189	1322	57484
167	2931	1052	1066	180	1322	57484
168	2931	1052	273A	189	1322	35803
169	2931	1052	246	429	1322	35803
174	2932	1052	1066	180	1322/1137	57484
176	2932	1049	246	429	1322	35052
177	2932	1049	246	429	1322	35052
178	2933	6150	246	429	1322	35052
179	2933	6150	246	429	1322	35052
180	2933	6150	246	429	1322	35052
181	2933	6150	246	429	1322	35052
182	2933	6150	246	429	1322	35052
188	2933	6150	246	429	1137/1316	35052
189	2933	6150	246	429	1322	35052
190	2933	5458	246	429	1322	35052

7PS

	Launch	S/N		Del Norte		S/N
<u>JD</u>	<u>EDP #</u>	<u>Fatho.</u>	<u>Master</u>	<u>DMU</u>	<u>Remote</u>	<u>T-2</u>
191	2933	5458	246	429	1322	35052
192	2933	5458	246	429	1322	35052
193	2933	5458	246	429	1322	35052
194	2933	5458	246	429	1322	35052
196	2933	5458	246	429	1322	35052
197	2933	5458	246	429	1322	35052
202	2933	5458	246	429	1322	35052
203	2933	5458	246	429	1322	35052
206	2933	5458	246	429	1316	57484
208	Hand-Held	Lead-Line	Using	H-P 3810B		
209	2933	5458	246	429	1316	35052
210	2933	5458	246	429	1316	57484
217	2933	5458	246	429	1316	57484
211	Hand-Held	Lead-Line	R/Az using HP 3810B			
212	2932	1053	See Boat Sheet using HP 3810B.			
216	2932	1053	See Boat Sheet using HP 3810B.			
217	2932	1053	169	189	1322	57484
221	2933	6150	246	429	1316	35052
243	2933	5458	246	429	212	57484
247	2933	5458	246	429	212	57484
252	2932	Hand-Held	246	429	212	35052

Lead-Line, Depth Gauge

276	2933	6150, 5458	See Boat Sheet.			
286	2933	Hand-Held	Lead-Line	See Boat Sheet.		

TDC SN# 127 was used on this survey.

✓
FPS

D. SOUNDING EQUIPMENT AND CORRECTIONS

Sounding equipment is listed by Julian Day used and serial number, in the equipment list, in Part C of this report. Two types of fathometers were used in this survey:

	<u>S/N's</u>
Ross Model 5000, Finline	1049, 1052, & 1053
Raytheon Model DE719B	6150, & 5458

Bar checks were taken twice daily, weather permitting, by each launch running hydrography. Velocity corrections were determined by plotting bar check data and TDC data on the same graph. The TDC curve was then shifted to fit the bar check data. Velocity tapes were cut from the shifted curve based on bar check data. *Bar check abstracts were unavailable to the verifier. This method was repeated during verification & velocity correctors applied accordingly.*

Settlement and squat data was determined by WHITING personnel for Launches 1014 and 1015. The MonArk was not observed for settlement and squat corrections since no way existed to monitor speed. The settlement and squat correctors for the MonArk were assumed to be negligible. *Draft for the MonArk was determined to be 0.8 ft. Draft for the launches is 1.7 ft. These correctors have been incorporated into the final reduced soundings*

All corrections to soundings are tabulated in the supplementary material and the appendices to this report. ✓

E. HYDROGRAPHIC SHEETS

All sheets were plotted on a Houston Instrument DP-3 Roll Plotter, S/N 7842-1, on board the WHITING. The origin and skew of the three (3) sheets plotted follows: ✓

<u>Sheet</u>	<u>Origin</u>	<u>Skew</u>
East	46°44'30"N 92°03'36"W	90, 21, 48
West	46°44'33"N 92°05'00"W	90, 21, 48
Inset	46°44'00"N 92°05'10"W	90, 15, 18

Field records were transferred to the Atlantic Marine Center, Norfolk, Virginia, (CAM3) for verification and smooth plotting. ✓

F. CONTROL STATIONS

The following is a list of all control stations used for this survey: ✓

<u>Sig. No.</u>	<u>Station Name</u>	<u>Year Established</u>
001	WEBC, 1952	1952
003	Duluth Enger Memorial Twr 1952	1952
004	Duluth General Elevator Flagstaff	1952
005	Duluth Central High School Cupola Spire	1905
006	Aerial Bridge SW Column of N. Pier	1905
009	West Gate 1980	1980
012	Minnesota Point NB USLS	1870
013	Cement 1980	1980
014	Superior Farmers Union Elevator Flagstaff	1952

used for calibration only

<u>Sig. No.</u>	<u>Station Name</u>	<u>Year Established</u>
018	Canal MNHD 1974	1974
019	451 USE 1974	1974
132	STA 132 1981	1981
150	STA 150 1981	1981
159	STA 159 1981	1981
201	WH-1-81, 1981	1981
202	St. Croix 1981	1981
203	461 USE 1981	1981
208	Key West 1981	1981
209	First United Methodist Church	1981 <i>Not Used</i>
907	Disk	1981
908	WEBC RM 1 1952	1952
909 (Non-recoverable)	451 USE Calibration (<i>Carto Code 254</i>)	1981 <i>Used for calibration only</i>

A point of the CRIB located north of the Duluth Ship Canal north jetty was used for a Del Norte calibration on JD 276. The distance from Canal MNHD 1974, SIG. #018 to the point of CRIB was measured with the HP-3810B. Point of CRIB was not used as a signal. *The detached position of this crib is in conflict with the position of the crib on TP-01078 (1980-82). The T-sheet position is shown on the smooth sheet.*

Stations 001, 003, 004, 005, 006, 009, 012, 013, 014, 018, and 132 were obtained from NGS published data. Stations 001 (WEBC 1952), #009 (West Gate 1980), 018 (Canal MNHD 1974), and 019 (451 USE 1974) were used for Range-Azimuth electronic control stations. Station 013 (Cement 1980) was used as a fixed calibration point. All other

NGS stations were landmarks, used as initials or azimuth checks. *These stations were checked with Operations. All necessary adjustments have been made and entered in this report and the computer file.*

DVM
JPS

Stations 132, 150, 159, 201, 202, 203, 208, 209, 908, and 909 were established by WHITING personnel to Third-Order, Class I accuracy. Stations 132, 159, and 909 were used for fixed calibration points. Station 909 is not recoverable. Stations 202 and 209 were used for azimuth checks. All other marks established by the WHITING were used as Range-Azimuth electronic control stations. ✓

A Fourth-Order station, DISK 1981, (Sta. #907), was established and used as a Range-Azimuth control station for lead line soundings taken along the pier faces in Lakehead Boat Basin. ✓ *(Carto Code 254)*

All horizontal control data has been submitted for processing to Operations Division, CAMI. ✓ ✓

G. HYDROGRAPHIC POSITION CONTROL

Range-Azimuth control using Del Norte transponders and a Wild T-2 theodolite was used wherever possible on this survey. The remaining slips and boat basins were surveyed using "See Boat Sheet Methods." ✓

Del Norte baseline calibrations were performed every 100 hours of use or every two weeks. Del Norte master units and DMU's remained paired between baseline calibrations. Calibrations were done twice daily in order to detect transponder failures and erratic drift patterns. The daily corrections applied to the survey ✓ were derived from the baseline calibration data. Linear Del Norte drift was assumed and the daily calibration data supported this theorem. The algorithm used to determine daily correctors from baseline data is:

N = Number of Days Between Baseline Calibrations

i = The Day 1, 2, 3, 4 N.

C = Baseline Corrector

c = Daily Corrector

$$c = \frac{C}{N} \times i \quad i = 1 \rightarrow N$$

On J.D. 165 Vesno 2932 hydro plotted on the bulkhead. By using the dailey calibration of -4.00, hydro plotted alongside the bulkhead.

See Boat Sheet work was performed on Julian Days 212, 216, 221, 243, 276,

and 286. On Days 212, 216, and 221 all work was performed in long narrow pier slips.

Equal distances were measured along the pier faces and flagged. The launch was operated at a constant speed. Times were recorded from a stop watch and compared with times scanned off the fathogram. A fix mark was put on the fathogram manually as the launch passed abeam of each marker. The narrowness of the slips allowed the helmsman to steer straight lines without external control other than fixed steering objects. See Boat Sheet work done on Days 243 and 276 was similar to the earlier work except mark intervals were controlled by time and supplemented by additional marks when the launch passed abeam of prominent shore features. Reconstruction processing was done with the aid of an aerial photograph. The work completed on JD 286 was stationary lead line work. The soundings obtained in the Coast Guard Base and Lake Head Boat Basin were controlled by a series of ranges and distances measured on the pier. The work in Howards Bay on JD 286 was controlled by measured distances on the pier. ✓

H. SHORELINE

The shoreline used on survey H-9953 was traced from TP-01078, TP-01081, and TP-01082, ^{of 1980} which are Class III documents. Field edit was completed by the WHITING and

submitted to AMC for verification in July 1981. ✓

I. CROSSLINES

Crosslines constitute approximately 10% of the total hydrography accomplished. Agreement with mainscheme was excellent (99% 0-1 ft. and 1% 1-2 ft.). ✓

J. JUNCTIONS

Survey H-9953 junctions to the East with survey H-9960 (1:10,000), completed 1981 season by the WHITING. Agreement with H-9960 is excellent. All soundings agree within 2 feet. *Joins H-10023 (1982) to the south, H-10024 (1982) to the north. A partial butt junction was effected with H-10023 (1982) because of poor surveying procedures. Junction with H-10024 (1982) is adequate.*

K. COMPARISON WITH PRIOR SURVEYS

The following prior surveys were compared to H-9953.

	<u>Registry No.</u>	<u>Scale</u>	<u>Yr. Surveyed</u>
1)	LS 1994	1:120,000	1956
2)	LS 1829	1:15,000	1944
3)	LS 257	1:60,000	1861
4)	LS 251	1:16,000	1861
5)	COE DS-7570	1:1,200	1979

Sheets 1 - 6

✓
915

1. Survey LS 1994 had one sounding to compare with H-9953, a 32 foot sounding at: Latitude $46^{\circ}46.9''N$
Longitude $96^{\circ}04.9''W$
- LS-1994 falls off limits of this survey.*

It was in good agreement with H-9953, (0 - 2').

2. Survey LS 1829 inset titled Duluth, Minnesota, was in excellent agreement with H-9953, the shoreline on the southside of the Duluth. ✓

3. Survey LS 257 had two soundings to compare with H-9953. These were:

a. 9 Feet at Latitude $46^{\circ}45'47.4''N$ H-9953 Sounding - ~~11~~⁹ Ft.
Longitude $092^{\circ}04'39.2''W$

b. 42 Feet at Latitude $46^{\circ}46'10.5''N$ H-9953 Sounding - ~~32~~³¹ Ft.
Longitude $092^{\circ}04'34.9''W$

The construction of the Duluth Harbor entrance is the most probable cause of the shoaler sounding found in more recent surveys. *See also Evaluation Report, Section 6.*

4. Survey LS-251 does not agree with H-9953. The entire Duluth/Superior area has been changed by dredging and constructive operations including the Duluth Harbor entrance and Superior entry. The growth and subsequent decline of the Duluth industrial complex has changed the shoreline dramatically since 1861. *See also Evaluation Report Section 6.*

5. COE Survey DS- 7570 was in good agreement with H-9953. (90% within 0 - 2'). ✓

Item Investigation

PSR Items #1 and #2 were investigated by the WHITING. A dive on PSR #1, *charted from a misc. source in lat. 46°47'20"N, long 92°05'26"W* was conducted on JD 252. Five detached positions were taken which locate the underwater ruins. Hand lead line depths were obtained using the divers to locate least depths. A development of the area was run on JD 247. *Chart item as shown on the present survey.*

Annex # 238

cribs, charted from LS-1829 (1944) in lat. 46°47'05"N, long. 92°05'32"W
 PSR Item #2 was found as charted. The structure is clearly visible in the aerial photographs, and appeared to be of sound structural integrity. A single detached position was taken on JD 247, POS# 8489. *D.P. is in conflict with topo position. Chart the crib & two dots as shown on the present survey.*

Annex # 2382

L. COMPARISONS WITH THE CHART

All comparisons were made with Chart 14975, 26th Edition, APR 26, 1980. East Sheet comparison showed good agreement with all charted soundings within 0 - 4 Ft.

(90% 0 - 2 Ft.) with the following exceptions: *See also Evaluation Report Section 7 "Comparison with Chart"*

EAST SHEET

	<u>Location</u>	<u>Charted Depth</u>	<u>H-9953 Depth</u>
1.	46°46'00"N 092°04'38"W	16'	20'
2.	46°45'54"N 092°04'39"W	8'	6' 11-13'
3.	46°45'57"N 092°04'28"W	20'	28' - 29'
4.	46°45'51"N 092°04'37.5"W	6'	12' ✓
5.	46°45'52"N 092°04'34"W	7'	18' ✓
6.	46°45'54"N 092°04'29"W	16'	3 20'
7.	46°45'56"N 092°04'22"W	28'	3 34'
8.	46°45'48"N 092°04'33"W	8'	15' 13' - 16'

*1
985*



12A

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SURVEY
NOAA Ship WHITING
P.O. Box 40
Duluth, MN 55801

September 9, 1981

TO : Lt. Warren T. Dewhurst, NOAA
Field Operations Officer

FROM : Edward J. Tylutki, NOAA
NOAA Ship WHITING

SUBJECT: Dive Report #1 - Investigation of PSR Item #1.

Diving operations were conducted on this date, September 9, 1981 (JD 252), to determine the disposition of PSR Item #1 of OPR-Z-137-WH-81. PSR Item #1 was on Sheet WH-5-10-81.

The operation progressed as follows: Launch 1014 departed the WHITING at 0830 LMT with the following crew: Ensign Ruiz (OIC), QM Tylutki (DiveMaster), YS Lowery (Diver) and ST Blevins (Coxswain) enroute to the PSR item. The divers prepared themselves and planned their method of attack while a shore party consisting of RCT Bradford and AB Noyes set up a range azimuth station at Canal MHD 1974. The launch calibrated the Del Norte and anchored near the PSR site approximately $\frac{1}{4}$ nautical mile southeast of shore buoy #2.

Beginning at 0935 the divers set two buoys delineating the farthest corners of the sunken crib and one buoy at the midpoint of the farthest end. The buoys were then placed at the midsection of the crib to further delineate the structure which connected to the beach. Leadline depths were taken at each of these buoys along with Range-Azimuth detached positions. A least depth of 10.8 feet was determined at Latitude 046/47/20.77 and Longitude 092/05/25.96. *10.8 depth is uncorrected.*

All survey information was recorded in the appropriate sounding volume.

All diving operations were completed on this PSR item by 1125 LMT. An attempt was made to locate and delineate the wreck THOMAS WILSON. Launch 1014 returned to the WHITING at 1506. No diving injuries were sustained during this operation. Please see the accompanying sketch of PSR #1 for further clarification.



12B

DULUTH MISSABE AND IRON RANGE

8527, 8528

PSR ITEM "I"
SUBMERGED RUINS

8524 8526
8525

46 47 15

L

46 47 00

TANKS
(landmark)

FLAGPOLE
(landmark)

DULUTH-SUPERIOR HARBOR
SUPERIOR FRONT CHANNEL
NORTH PIER LIGHT

SOUTH BREAKWATER OUTER LIGHT

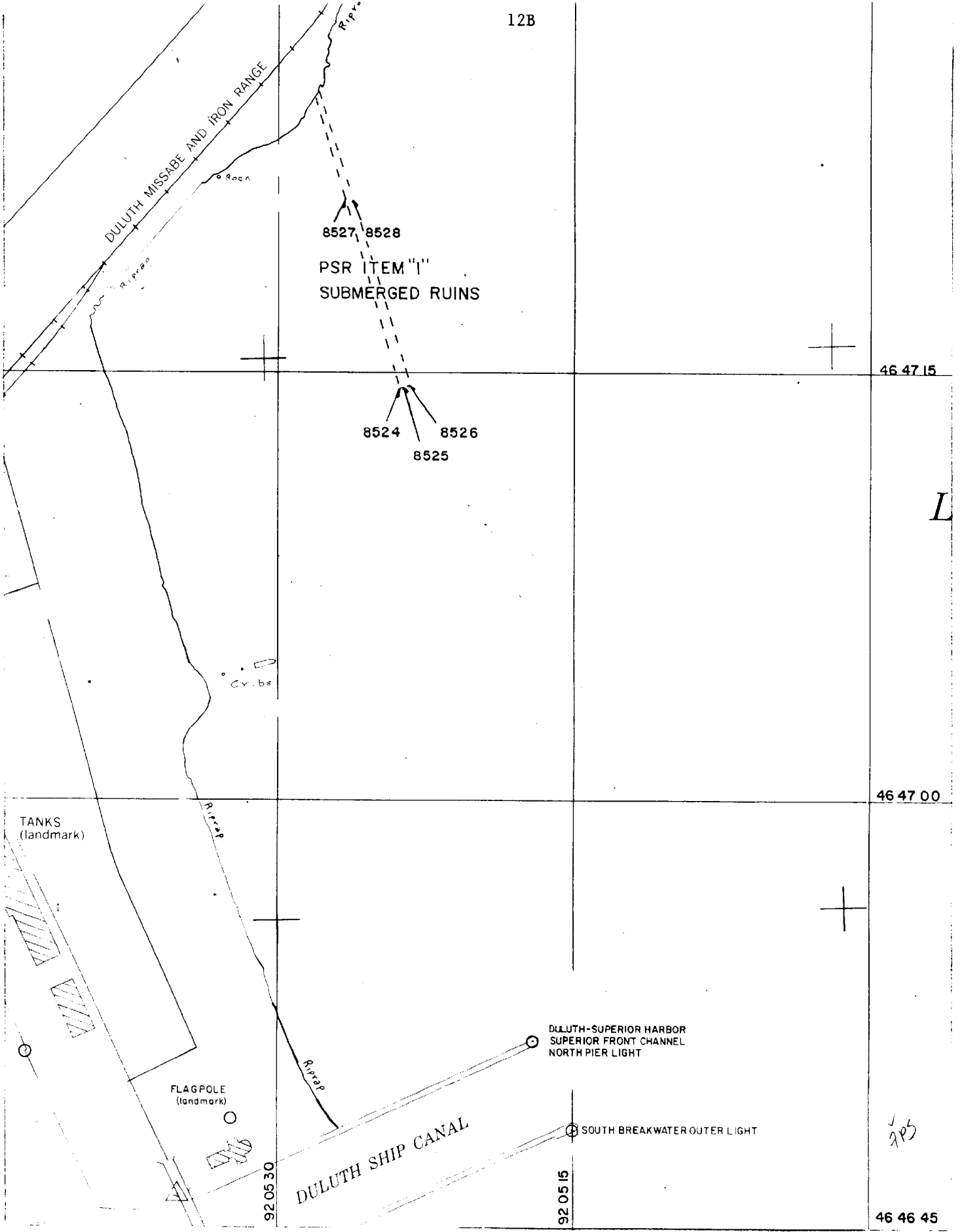
DULUTH SHIP CANAL

92 05 30

92 05 15

46 46 45

APB



9.	46°45'40"N	092°04'34"W	5'	<i>11' 8'-10'</i>
	Buoy DP 5067 NOT CHARTED <i>(priv maint'd)</i>			
10.	46°45'04"N	092°04'36"W	4'	<i>8'-9'</i>

WEST SHEET

West Sheet comparison showed good agreement with all charted soundings, within 0 - 4 Ft. (90% 0 - 2 Ft.) with the following exceptions:

	<u>LOCATION</u>	<u>Charted Depth</u>	<u>H-9953 Depth</u>
1.	46°46'26"N 092°05'34"W	5'	<i>11' 8'-10'</i>
2.	46°46'23"N 092°05'36"W	7'	<i>12' 9'-11'</i>
3.	46°46'21"N 092°05'34"W	4'	<i>10' 2'-10'</i>
4.	46°45'24"N 092°05'11"W	33'	<i>42' 28'-42'</i>
5.	46°45'26"N 092°05'17"W	33'	<i>30' 32'-34'</i>
6.	46°46'11"N 092°06'35"W	10'	<i>11' 18'-26'</i>
7.	46°46'11"N 092°06'33"W	14'	<i>20'-21'</i>
8.	46°46'12"N 092°06'29"W	5'	<i>11'-23'</i>
9.	46°46'12"N 092°06'31"W	10'	<i>22' 21'-29'</i>
10.	46°46'14"N 092°06'27"W	9'	<i>25'-27'</i>
11.	46°46'15"N 092°06'24"W	7'	<i>21' 26'-29'</i>
12.	46°46'16"N 092°06'23"W	8'	<i>23' 22'-28'</i>
13.	46°46'23"N 092°06'28"W	15'	<i>22' 21'</i>

All soundings in the Duluth Harbor Basin northern section were 0 to 7-ft. deeper than the controlling depths except the following:

7/25

<u>Location</u>	<u>Controlled Depth</u>	<u>H-9953 Depth</u>
46°46'10"N 092°06'11"W	23.5'	30' <i>rescanned during evaluation and found to be in error. Correct depth is 30ft.</i>

This difference presented no hazard to navigation.

INSET SHEET

718

The Inset Sheet comparison showed good agreement with all charted soundings, within 0 - 4 Ft. (95% 0 - 2 Ft.) with no exceptions. All soundings in the West Gate Basin and Howards Bay sections were 0- to 8-ft. deeper than the controlling depths except the following: *No inset on smooth sheet, this area included as part of the smooth sheet at 1:5,000.*

<u>Location</u>	<u>Controlled Depth</u>	<u>H-9953 Depth</u>
46°44'31"N 092°05'52"W	19.5'	17'

See Evaluation Report for "Controlling Depths" comparison.

M. ADEQUACY

Survey H-9953 is considered complete and adequate for charting. *concur*

N. AIDS TO NAVIGATION

FLOATING AIDS

WEST SHEET

<u>Buoy #</u>	<u>POS. #</u>	<u>SURVEY</u>		<u>CHARTED POSITION</u>		<u>DIFFERENCE</u>
		<u>LATITUDE</u>	<u>LONGITUDE</u>	<u>SECONDS</u>	<u>CHARTED SURVEY</u>	
<i>Mid channel</i> MoA LT. 7210		46°46' ² 29.978"	092°05' ³ 58.967"	29.980	58.507	8 W
C "1" ⁹ ✓	7211	46°46' ⁹ 34.776"	092°05' ⁴ 38.963"	34.441	38.462	14 NW
C "3" ² ✓	7212	46°46' ² 24.688"	092°05' ⁷ 42.635"	24.613	41.612	22 W
N "2" ⁵ ✓	7209	46°46' ⁵ 22.532"	092°06' ² 10.762"	22.390	10.916	6 NE

718

⊕ "5" Lt. 7208	46°46'04. ¹³ 11 "	092°05'50. ¹⁶ 13 "	04.253	50.180	4 SSE
C "A" ✓ 7207	46°46'12. ⁸ 66 "	092°05'34. ⁶ 25 "	12.769	34.216	5 SW
C "B" ✓ 7206	46°45'59. ⁶ 94 "	092°05'25. ⁵ 19 "	59.566	24.808	15 NW
C "C" ✓ 7205	46°45'46. ⁴ 62 "	092°05'16. ⁴⁰ 37 "	46.738	17.186	17 ESE
⊕ "7" Lt. 7200	46°45'28. ⁹ 47 "	092°05'23. ⁸⁰ 78 "	27.93	23.84	17 N
⊕ "9" Lt 7199	46°45'08. ⁸ 45 "	092°05'16. ⁹ 71 "	09.635	17.097	36 SSE
N "20" ✓ 7198	46°44'47. ⁸² 3 "	092°05'07. ⁴ 52 "	47.74	07.75	5 ENE
N "6" ✓ 7201	46°45'44. ¹ 089 "	092°05'10. ^{7.30} 832 "	43.936	09.065	38 W
N "4" ✓ 7202	46°45'44. ¹⁰ 089 "	092°05'09. ³ 602 "	44.568	10.49	24 SE
N "2" ✓ 7203	46°45'43. ^{4 11} 998 "	092°05'07. ^{10.86} 273 "	43.98	12.28	106 E
C "1" ✓ 7204	46°45'44. ² 604 "	092°05'08. ⁸ 55 "	45.77	13.26	106 ESE

priv. maintn from June 1 to Oct. 1

EAST SHEET

Buoy #	POS. #	LATITUDE	LONGITUDE	SECONDS	DIFFERENCE
					CHARTED SURVE
N "2" ✓	5069	46°47'15. ⁴ 384 "	092°05'22. ²¹ 555 "	15.259 - 22.002	12 WNW
Private	5068 ✓	46°46'41. ⁸⁶ 940 "	092°05'07. ⁶⁰ 766 "	None	N/A
Private	5067	46°45'52. ² 474 "	092°04'14. ²² 307 "	None	N/A

priv. maintn

INSET SHEET

C "1" ✓	1529	46°45'01. ⁶ 744 "	092°06'22. ⁷ 445 "	02.245 - 22.712	16 SW
N "2" ✓	1528	46°44'52. ⁴⁰ 388 "	092°06'23. ⁷ 431 "	53.124 - 23.528	23 SSW
N "2" ✓	1527 ✓	46°44'38. ² 282 "	092°06'07. ³ 742 "	38.618 - 07.985	12 S

*DUM
✓
FPS*

All fixed aids were found as charted. The fixed aids and floating aids were properly maintained and positioned to perform their intended purpose. *Do not concur. See 76-40's for charting information.*

Buoys N "2", "4", "6", and C "1", Positions #7201, 7202, 7203, and 7204 are *from June 1 to Oct 1* privately maintained and repositioned frequently by the yacht club. *(Hearding Is. channel entrance)*

#5067 - {lat. 46° 45' 52.42" N lat 46° 46' 41.86" N } #5068
{long. 92° 04' 14.22" W long. 92° 05' 07.60" W }

Private buoys at Position #5067 and 5068 should be added to the chart at the survey position. *Their purpose was not determined on the survey. A charting resolution is deferred to the chart compiler (not listed in 1982 U.S.C.G. L.L.)*

O. STATISTICS

	<u>Launch</u>		<u>MonArk</u>
	<u>1014</u>	<u>1015</u>	
Positions	1514	802	2208
N. Miles Run	117	62	171
Sq. N. M. Surveyed	2	1	3
TDC Casts	7	2	4
Bottom Samples	9	0	177

Totals for H-9953

4524 Positions
186 Bottom Samples
350 N. Miles Run
6 Sq. N. Miles Surveyed
13 TDC Casts

P. MISCELLANEOUS

1. The sheets forwarded with this report were plotted with incorrect velocity correctors. The velocity tapes submitted to (CAM3) have been checked and are correct. *Because of irregularities approximately 50 hrs were spent during verification recomputing the velocity correctors and applying them during processing.*
2. The East Sheet signals and black grid were plotted on a different plotter than the soundings. The soundings and the red grid on the East Sheet were plotted on same plotter as the West Sheet and Inset. ✓
3. The excess data acquired on JD's 203, 206, 209, and 210, that was run at 10-meter spacing, was processed but not plotted due to unnecessary sounding density. *Plotted during verification and inserted in the Descriptive Report.*
4. The MonArk was powered by an 85-H.P. outboard at the start of the season. The motor was replaced on JD 202 with two 60-H.P. outboards. Draft measurements taken before and after the change showed no appreciable difference, (less than 1" at the transducer). *No settlement & squat correctors were acquired during the survey. Field used "0" corrector for all speeds. 0.8' draft was used for entire survey.*
5. Bar checks taken on JD's 209 and 210 were not included in the velocity corrector computations since the sounding data for these days was excessed. *Used Velocity Table 7 for this data. This table covers JD-202-221.*

Q. RECOMMENDATIONS

None.

R. AUTOMATED DATA PROCESSING

	<u>Program Name</u>	<u>Number</u>	<u>Version Date</u>
1.	Range-Azimuth Logger	FA 181	1/30/76

*DUM
GPS*

2.	Grid, Signal, and Lattice Plot	RK 201	4/18/75
3.	Visual Station Table Load	RK 212	4/01/74
4.	Range-Azimuth Non Real Time Plot	RK 216	2/05/76
5.	Utility Computations	RK 300	2/05/76
6.	Reformat and Data Check	RK 330	5/04/76
7.	Geodetic Inverse/Direct Computations	RK 407	9/25/78
8.	Layer Correction for Velocity	RK 530	5/10/76
9.	Elinore--Line Oriented Editor	AM 602	5/20/75
10.	Tape Duplicator	RK 606	8/22/74
11.	Line Printer List	RK 612	3/22/78

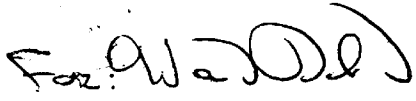
S. REFERRAL TO REPORTS

Field Edit Report sent to CAM52, date 7/81.

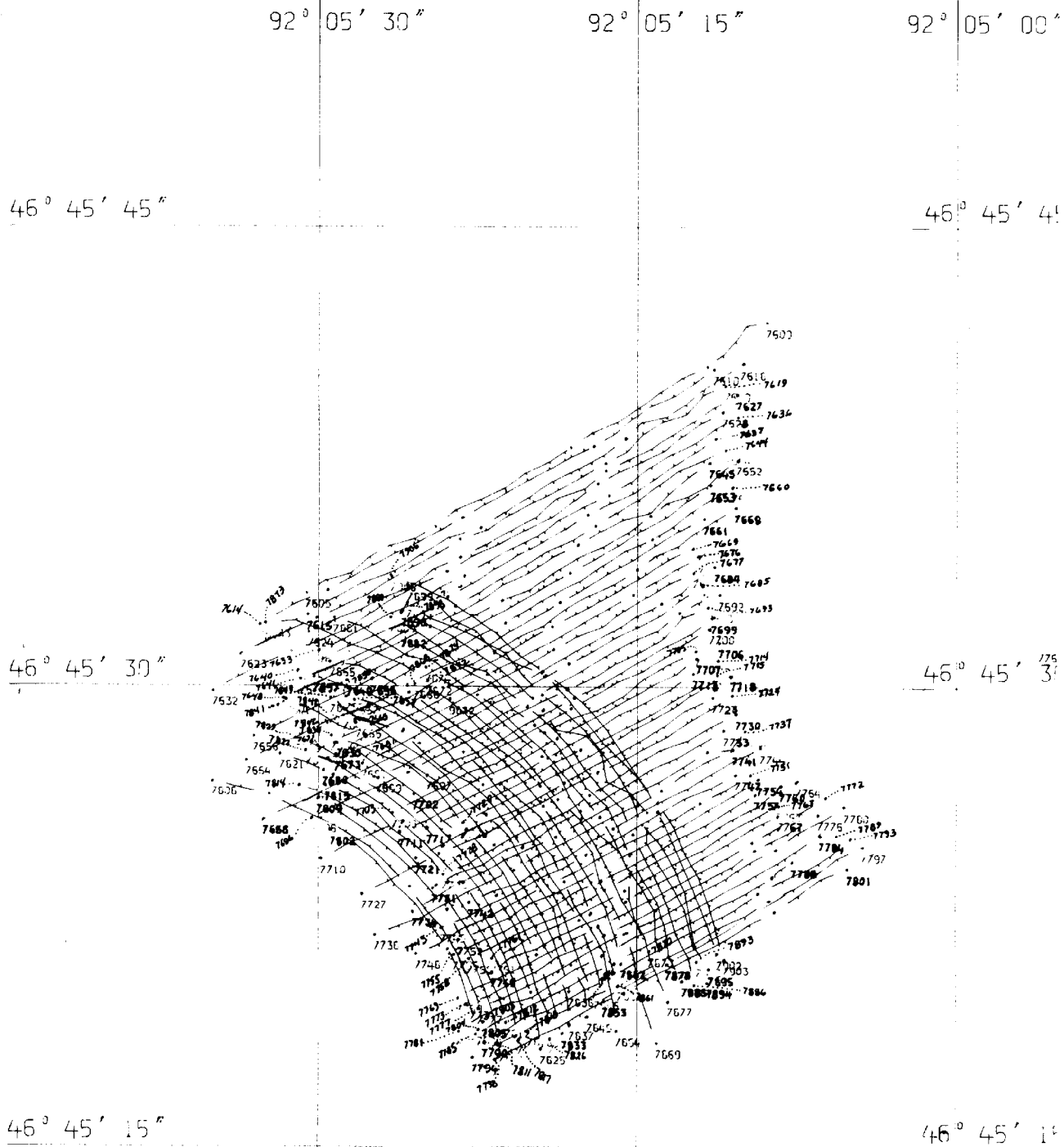
Horizontal Control Report was submitted to CAM1, date 11/81. ✓

✓
GPS

Respectfully submitted,

A handwritten signature in black ink, appearing to read "David K. Howard". The signature is stylized with a large, sweeping initial "D" and "H".

David K. Howard, Lt., NOAA



Position Overlay To Accompany H- 9953
 Scale 1: 5, 000
 Development Number 1

92° 05' 30"

92° 05' 15"

92° 05' 00"

46° 45' 45"

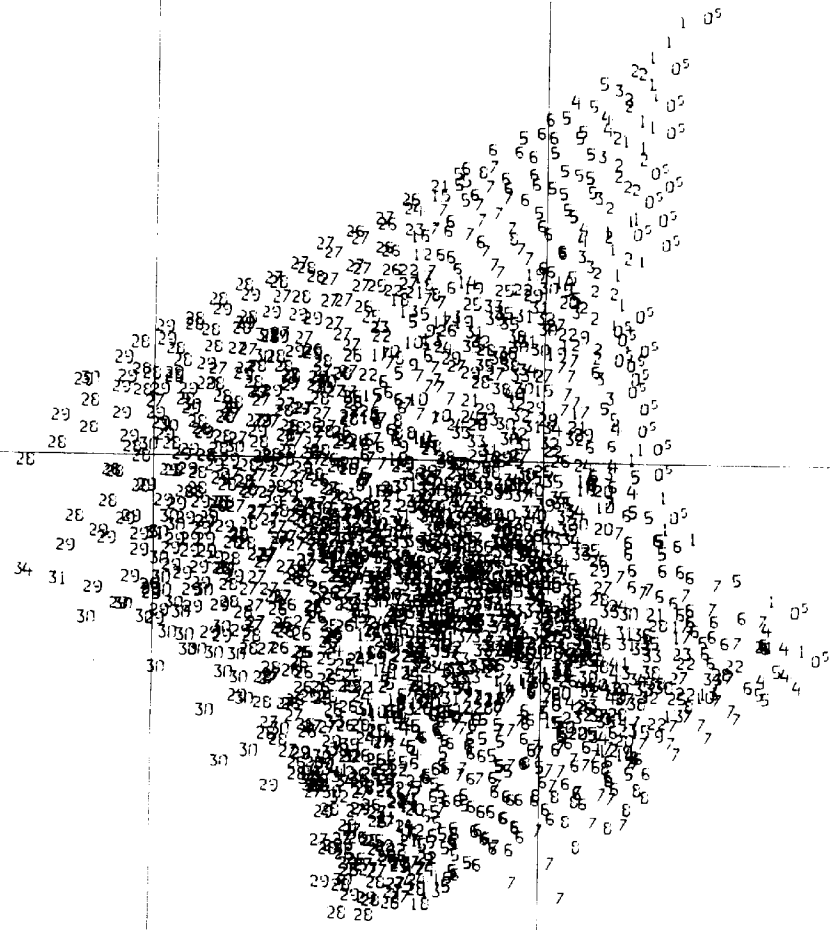
46° 45' 4

46° 45' 30"

46° 45' 30

46° 45' 15"

46° 45' 15



Sounding Overlay To Accompany H - 9953

Scale 1: 5,000
Development Number 1

1 of 3

92° 05' 30"

92° 05' 15"

92° 05' 00"

92° 05' 30"

92° 05' 15"

92° 05' 00"

46° 45' 45"

46° 45' 45"

46° 45' 30"

46° 45' 30"

46° 45' 15"

46° 45' 15"

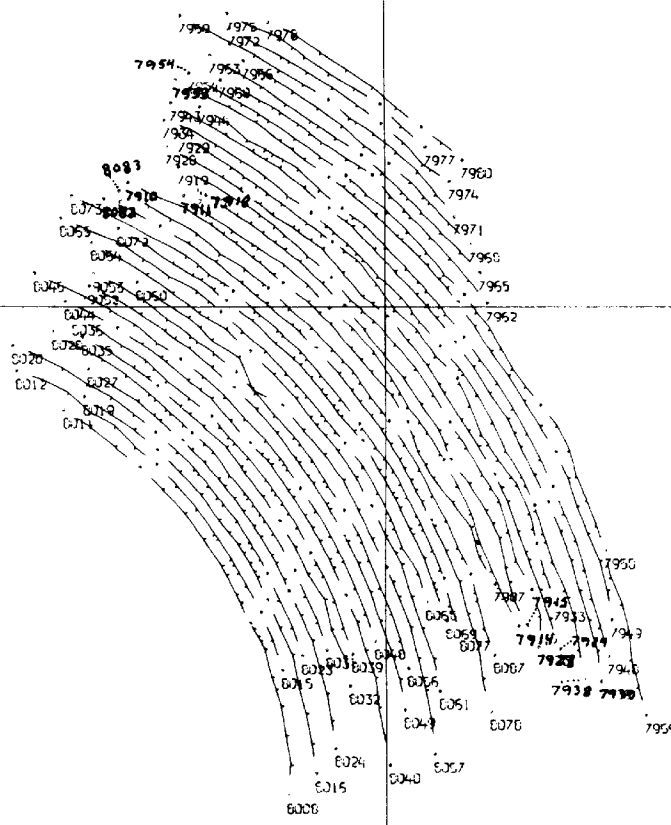
Position Overlay To Accompany H- 9953
Scale 1: 5,000
Development Number 1

2 of 3

92° 05' 30"

92° 05' 15"

92° 05' 00"



92° 05' 30"

92° 05' 15"

92° 05' 00"

46° 45' 45"

46° 45' 45"

46° 45' 30"

46° 45' 30"

46° 45' 15"

46° 45' 15"

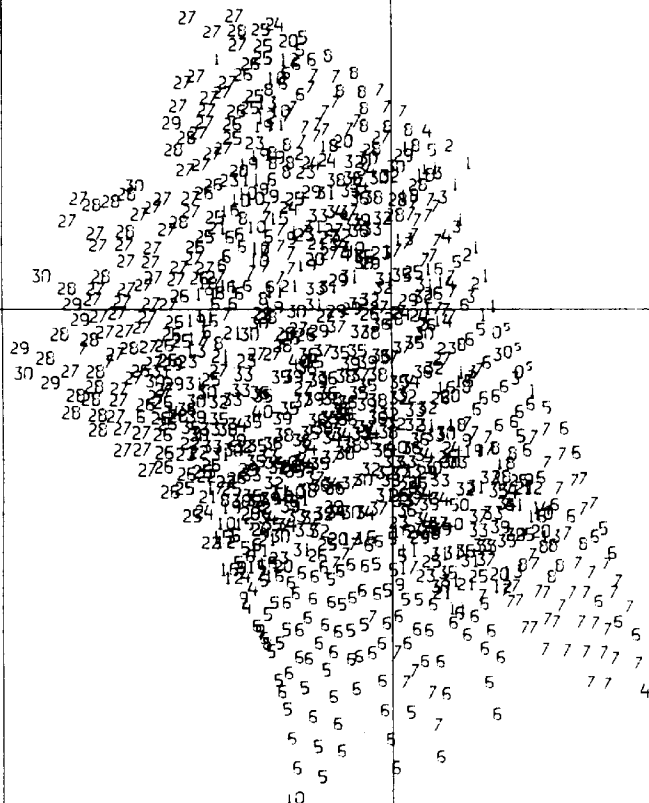
Sounding Overlay To Accompany H-9953

Scale 1: 5,000
Development Number 1

92° 05' 30"

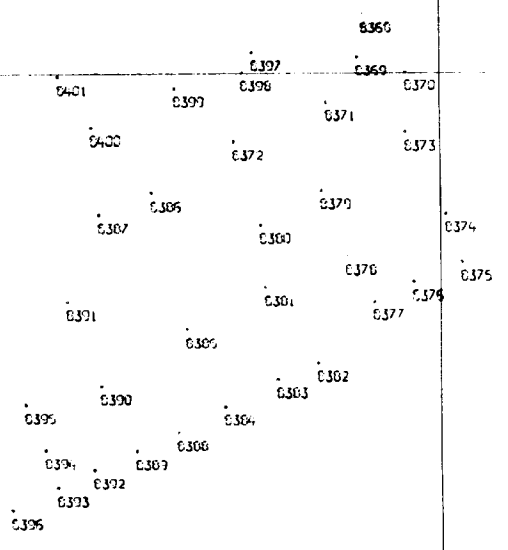
92° 05' 15"

92° 05' 00"



46° 46' 40" 92° 05' 40" 92° 05' 30" 46° 46'

46° 46' 30" 46° 46'



Position Overlay To Accompany H-9953
Scale 1:2,500
LAKEHEAD BOAT BASIN

46° 46' 20" 46° 46'

3 of 3

92° 05' 40" 92° 05' 30"

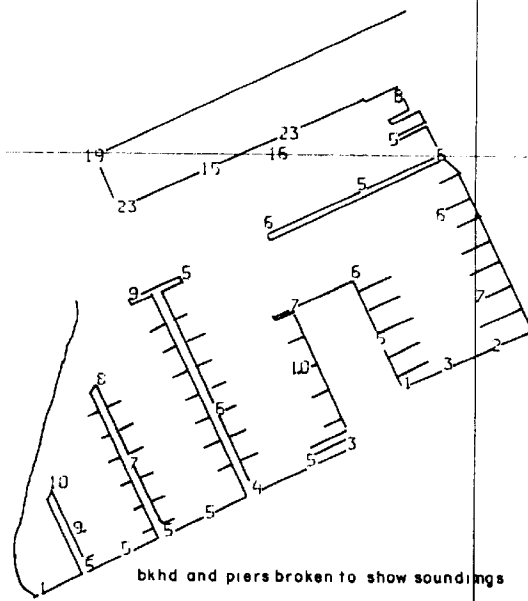
90 40 40

92° 05' 40"

92° 05' 30" 46° 46'

46° 46' 30"

46° 46'



Sounding Overlay To Accompany H- 9953
Scale 1:2,500

46° 46' 20"

46° 46'

LAKEHEAD BOAT BASIN

3 of 3

92° 05' 40"

92° 05' 30"

F. LIST OF STATIONS

I. LANDMARKS FOR CHARTS

* NOTE : ALL FORM 76-40'S
ARE COPIES OF
THOSE SUBMITTED
WITH THE FIELD
EDIT REPORT FOR
OPR-Z137.

SIGNAL TAPE
H-9953

*	001	0	46	47	24342	092	06	49759	250	0201	000000	WEBC 1952
*	003	0	46	46	34185	092	07	29003	139	0000	000000	DULUTH ENGER MEMORIAL TOWER 1952
*	004	0	46	46	11550	092	06	38140	139	0000	000000	DULUTH GENERAL ELEVATOR FLAGSTAFF 1952
*	005	0	46	47	20600	092	05	59841	139	0000	000000	DULUTH CENTRAL HIGH SCHOOL CUPOLA SPIRE 1905
*	006	0	46	46	46130	092	05	35070	139	0000	000000	AERIAL BRIDGE SW COLUMN OF NORTH PIER 1905
*	008	0	46	45	38602	092	05	55842	139	0000	000000	DULUTH PEAVEY ELEVATOR COAST STACK, 1921 landmark only
*	009	0	46	44	46696	092	06	26542	250	0000	000000	WEST GATE 1980
*	010	0	46	45	41758	092	04	46747	139	0000	000000	DULUTH POLICE RADIO STATION KWAMAST, 1952
*	012	0	46	45	27978	092	04	42663	139	0000	000000	MINNESOTA POINT NORTH BASE USLS 1870
*	011	0	46	45	30810	092	04	41470	139	0000	000000	DULUTH PARK POINT SCHOOL STAFF 1921
*	013	0	46	43	59977	092	04	28374	139	0000	000000	CEMENT 1980
*	014	0	46	44	24692	092	06	05352	139	0000	000000	SUPERIOR FARMERS UNION ELEVATOR FLAG STAFF 1952
*	018	0	46	46	51587	092	05	17178	250	0000	000000	CANAL MNHD 1974
*	019	0	46	46	2998 ⁶	092	05	37126	250	0000	000000	451 USE 1974
o	132	0	46	46	10470	092	06	17782	139	0000	000000	STA 132 1981
o	150	0	46	44	46151	092	06	11973	250	0000	000000	STA 150 1981
o	159	0	46	44	23932	092	06	10297	139	0000	000000	STA 159 1981
o	201	0	46	47	17391	092	06	45735	250	0201	000000	WH-1-81
o	202	0	46	44	21530	092	05	30565	139	0000	000000	ST. CROIX 1981
o	203	0	46	45	16579	092	05	36894	250	0000	000000	461 USE 1981
o	208	0	46	44	55937	092	05	58249	250	0000	000000	KEY WEST 1981
o	209	4	46	47	47502	092	06	21051	139	0000	000000	FIRST UNITED METHODIST CHURCH 1981
o	907	0	46	46	29323	092	05	36703	139	0000	000000	DISK, 1981 (21m from 451 USE)
*	908	0	46	47	24537	092	06	49362	250	0201	000000	WEBC RM 1, 1952
o	909	0	46	46	3003 ⁶	092	05	37194	253	0000	000000	451 USE CALIBRATION

* Obtained from NGS published data

o Established by WHITING or AMC prsonnel, 1981 field season

NON-FEDERAL GOVERNMENT LANDMARKS FOR CHARTS

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

ORIGINATING ACTIVITY

- HYDROGRAPHIC PARTY
 - GEODETIC PARTY
 - PHOTO FIELD PARTY
 - COMPILATION ACTIVITY
 - FINAL REVIEWER
 - QUALITY CONTROL & REVIEW GRP.
 - COAST PILOT BRANCH
- (See reverse for responsible personnel)

Replaces CGCS Form 567.
 TO BE CHARTED
 TO BE REVISED
 TO BE DELETED

REPORTING UNIT
(Field Party, Ship or Office)
NOAA Ship WHITTING

STATE
Minnesota

LOCALITY
Duluth Harbor

DATE
7/81

The following objects HAVE HAVE NOT been inspected from seaward to determine their value as landmarks.
 OPR PROJECT NO. Z137-WH-81

JOB NUMBER
SURVEY NUMBER
TP-01078

DATUM
North American 1927

METHOD AND DATE OF LOCATION
(See instructions on reverse side)

CHARTS AFFECTED

CHARTING NAME	DESCRIPTION <i>(Record reason for deletion of landmark or aid to navigation. Show triangulation station names, where applicable, in parentheses)</i>	LATITUDE		LONGITUDE		OFFICE	FIELD	CHARTS AFFECTED
		D.M. Meters	//	D.P. Meters	//			
RTR ✓	(Duluth TV Station WEBG, Mast, 1952)	46 47	25.76	92 06	50.093	Triangulation	F-3-7-V 7/12/81	14975 14966
SPIRE ✓	(Duluth Cath. or Me. Church, Spire, 1905)	46 47	15.92	92 06	18.96	Triangulation	V-Vis 6/81	14975
TOWER STA. No 5 ✓	(Duluth Central High School, Cupola)	46 47	20.601	92 05	59.841	Triangulation	F-3-7-V 7/12/81	14975
STACK ✓		46 47	08.64	92 05	48.14	80 EC 5735 8/31/80	F-3-7-V 7/12/81	14975
TANK ✓		46 46	58.78	92 05	45.46	80 EC 5737 8/31/80	F-3-7-V 7/12/81	14975
TANK ✓		46 46	58.95	92 05	44.96	80 EC 5737 8/31/80	F-3-7-V 7/12/81	14975
FLAGPOLE ✓		46 46	48.84	92 05	32.39	80 EC 5737 8/31/80	F-3-7-V 7/12/81	14975
FLAGPOLE ✓	(Duluth General Elevator Flagstaff, 1952)	46 46	11.55	92 06	38.14	Triangulation	F-3-7-V 7/12/81	14975
TV MAST TALLER OF ✓	TWO	46 47	21.35	92 06	50.72	80 EC 5737 8/31/80	F-3-7-V 7/12/81	14975 14966
RTR ✓	delete-gone	46 46	18.53	92 05	26.19	80 EC 5737 8/31/80	V-Vis	14975

1-635153

Replaces C&GS Form 567.

NON-NAVIGATIONAL LANDMARKS FOR CHARTS

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

ORIGINATING ACTIVITY

- HYDROGRAPHIC PARTY
 - GEODETIC PARTY
 - PHOTO FIELD PARTY
 - COMPILATION ACTIVITY
 - FINAL REVIEWER
 - QUALITY CONTROL & REVIEW GRF
 - COAST PILOT BRANCH
- (See reverse for responsible personnel)

REPORTING UNIT (Field Party, Ship or Office)
NOAA Ship WHITTING

STATE
Minnesota

LOCALITY
Duluth Harbor

DATE
7/81

The following objects HAVE HAVE NOT been inspected from seaward to determine their value as landmarks.

OPR PROJECT NO. 2137-WH-81

JOB NUMBER

SURVEY NUMBER TP-01078

DATUM
North American 1927

CHARTING NAME	DESCRIPTION (Record reason for deletion of landmark or aid to navigation. Show triangulation station names, where applicable, in parentheses.)	LATITUDE		LONGITUDE		METHOD AND DATE OF LOCATION (See instructions on reverse side)	OFFICE	FIELD	CHARTS AFFECTED
		° / ' " D.M. Meters	° / ' " D.P. Meters	° / ' " D.M. Meters	° / ' " D.P. Meters				
TOWER ✓	(Duluth U.S.C.G. Lookout Tower, 1952) delete - gone	46 46	20.893	92 05	22.840	Triangulation	V-Vis 7/81	14975	
TV MAST X	delete - not of landmark value.	46 46.3		92 06.8			V-Vis 7/81	14975	
NEON X SIGN, LETTERS "NC"	delete - gone	46 47.0		92 06.1			V-Vis 7/81	14975	
NEON SIGN FIGURE "I" X	delete - gone	46 47.1		92 06.0			V-Vis 7/81	14975	
W S SIG STA X	delete - gone	46 46.4		92 05.4			V-Vis 7/81	14975 14966	
CHY X	delete - not of landmark value (2-120685)	46 46.4		92 05.4			V-Vis 7/81	14975	

Replaces CMGS Form 567.

NON-FLOATING AIDS

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

ORIGINATING ACTIVITY

- HYDROGRAPHIC PARTY
 - GEODETIC PARTY
 - PHOTO FIELD PARTY
 - COMPILATION ACTIVITY
 - FINAL REVIEWER
 - QUALITY CONTROL & REVIEW GRP
 - COAST PILOT BRANCH
- (See reverse for responsible personnel)

TO BE CHARTED
 TO BE REVISED
 TO BE DELETED

REPORTING UNIT (Field Party, Ship or Office)
NOAA Ship WHITTING

STATE
Minnesota

LOCALITY
Duluth Harbor

DATE
11/7/81

The following objects HAVE HAVE NOT been inspected from seaward to determine their value as landmarks.

OPR PROJECT NO. 2137-WH-81

JOB NUMBER

SURVEY NUMBER TP-01078

CHARTING NAME	DESCRIPTION <small>(Record reason for deletion of landmark or aid to navigation. Show triangulation station names, where applicable, in parentheses)</small>	LATITUDE		LONGITUDE		METHOD AND DATE OF LOCATION <small>(See instructions on reverse side)</small>	FIELD	CHARTS AFFECTED
		° / ' "	D.M. Meters	° / ' "	D.P. Meters			
North Pier Light ✓	L.L. #1809	46 46	51.55	92 05	17.06	80 EC 5737 8/31/80	V-Vis 6/81	14975 14966
S. Breakwater Outer Light ✓	L.L. #1808	46 46	48.46	92 05	15.02	80 EC 5737 8/31/80	V-Vis 6/81	14975
S. Breakwater Inner Light ✓	L.L. #1810	46 46	43.58	92 05	30.53	80 EC 5737 8/31/80	V-Vis 6/81	14975 14966
Marina Light 2 ✓	L.L. #1812.10	46 46	29.13	92 05	38.73		V-Vis 6/81	14975
Marina Light 4 ✓	L.L. #1812.20	46 46	17.85	92 05	35.72		V-Vis 6/81	14975

See 6-63 (82)

NOAA FORM 76-40
(8-74)

~~NONEXHAUSTIVE~~ LANDMARKS FOR CHARTS

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

ORIGINATING ACTIVITY

- HYDROGRAPHIC PARTY
 - GEODETIC PARTY
 - PHOTO FIELD PARTY
 - COMPILATION ACTIVITY
 - FINAL REVIEWER
 - QUALITY CONTROL & REVIEW GRF
 - COAST PILOT BRANCH
- (See reverse for responsible personnel)

Replaces C&GS Form 567.
 TO BE CHARTED
 TO BE REVISED
 TO BE DELETED

REPORTING UNIT
 NOAA Ship WHITTING

STATE
 Wisconsin
 Minnesota

LOCALITY
 Duluth Superior Harbor

DATE
 7/81

The following objects HAVE HAVE NOT been inspected from seaward to determine their value as landmarks.

CHARTING NAME	DESCRIPTION <small>(Record reason for deletion of landmark or aid to navigation. Show triangulation station names, where applicable, in parentheses.)</small>	LATITUDE		LONGITUDE		METHOD AND DATE OF LOCATION <small>(See instructions on reverse side)</small>	FIELD	CHARTS AFFECTED
		° / ' "	D.M. Meters	° / ' "	D.P. Meters			
STACK ✓	delete - not of landmark value	46 44	10.82	92 06	01.32	80 EC 5798 8/31/80	V-Vis 7/81	14975
CHIMNEY ✓	delete - not of landmark value	46 44	10.23	92 05	59.16	80 EC 5798 8/31/80	V-Vis 7/81	14975
ELEV ✓	add to ss. (Superior Farmers Union Elevator Flag 1952)	46 44	24.692	92 06	05.352	Triangulation	F-3-7-V 7/13/81	14975
CHIMNEY ✓	(Superior Globe Elev. Co. Stack, 1921)	46 44	32.97	92 06	23.46	Triangulation	F-3-7-V 7/13/81	14975
TANK ✓	delete - gone	46 44	34.32	92 06	23.30	80 EC 5798 8/31/80	V-Vis 7/81	14975
STACK ✓	delete - gone	46 45	50.80	92 06	05.23	80 EC 5799 8/31/80	F-3-7-V 7/13/81	14975
STACK ✓	delete - gone	46 45	7	92 06			V-Vis 7/81	14975
CHIMNEY ✓	delete - gone	46 45	6	92 07			V-Vis 7/81	14975
STACK ✓	(Duluth Peavey Elev. Co. Stack, 1921)	46 45	38.602	92 05	55.842	Triangulation	F-3-7-V 7/13/81	14975

63542

NONFLOATING AIDS ~~ON LAKES SUPERIOR AND MICHIGAN~~
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

U.S. DEPARTMENT OF COMMERCE

Replaces C&GS Form 567.

TO BE CHARTED
 TO BE REVISED
 TO BE DELETED

REPORTING UNIT: NOAA Ship WHITTING

STATE: Wisconsin
 LOCALITY: Duluth Superior Harbor

DATE: 7/81

ORIGINATING ACTIVITY:
 HYDROGRAPHIC PARTY
 GEODETIC PARTY
 PHOTO FIELD PARTY
 COMPILATION ACTIVITY
 FINAL REVIEWER
 QUALITY CONTROL & REVIEW GROUP
 COAST PILOT BRANCH

The following objects HAVE HAVE NOT been inspected from seaward to determine their value as landmarks.

OPR PROJECT NO.: 2137-WH-81

JOB NUMBER: TP-01081

SURVEY NUMBER: North American 1927

DATUM: North American 1927

METHOD AND DATE OF LOCATION (See instructions on reverse side)

CHARTING NAME	DESCRIPTION <small>(Record reason for deletion of landmark or aid to navigation. Show triangulation station names, where applicable, in parentheses.)</small>	LATITUDE		LONGITUDE		OFFICE	FIELD	CHARTS AFFECTED
		° / ' "	D.M. Meters	° / ' "	D.P. Meters			
* Rices Point Leading Light	delete - discontinued (L.N.M. #16, L.L. #1799 1981)	46 45.3	211.30	92 06.1	40.15	80 EC 5799 8/31/80	F-3-7-V 7/13/81	14975
Duluth Marine Terminal East Light	L.L. #1815	46 45.6	211.30	92 05.5	37.45	80 EC 5799 8/31/80	F-3-7-V 7/13/81	14975
Duluth Marine Terminal South Light	L.L. #1816	46 45.6	211.30	92 05.5	40.15	80 EC 5799 8/31/80	F-3-7-V 7/13/81	14975

Su L. 635 (82)

~~MINNESOTA~~ LANDMARKS FOR CHARTS

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

ORIGINATING ACTIVITY

Replaces C&GS Form 567.

TO BE CHARTED
 TO BE REVISED
 TO BE DELETED

REPORTING UNIT: ~~NOAA Ship WHITTING~~
STATE: Wisconsin
LOCALITY: Duluth Superior Harbor
DATE: 7/81

HYDROGRAPHIC PARTY
 GEODETIC PARTY
 PHOTO FIELD PARTY
 COMPILATION ACTIVITY
 FINAL REVIEWER
 QUALITY CONTROL & REVIEW CRP
 COAST PILOT BRANCH

(See reverse for responsible personnel)

The following objects HAVE HAVE NOT been inspected from seaward to determine their value as landmarks.

OPR PROJECT NO. 2137-WH-81
JOB NUMBER
SURVEY NUMBER TP-01082

DATUM: North American 1927

METHOD AND DATE OF LOCATION (See instructions on reverse side)

CHARTING NAME	DESCRIPTION (Record reason for deletion of landmark or aid to navigation. Show triangulation station names, where applicable, in parentheses)	LATITUDE		LONGITUDE		OFFICE	FIELD	CHARTS AFFECTED
		° /	// D.M. Meters	° /	// D.P. Meters			
R MAST ✓	(Duluth Pol. Rad. Sta, KWA 939, Mast, 1952)	46	45	41.758	92	04	46.747	Triangulation F-3-7-V 7/13/81 14975
CHIMNEY ✓	(Duluth Park Point School Stack, 1921)	46	45	30.81	92	04	41.47	Triangulation F-3-7-V 7/13/81 14975
AERO ✓ (60 ft Survey Light)		46	43	38.21	92	02	46.16	80 EC 5759 8/31/80 7/13/81 14966
TANK ✓		46	44	09.04	92	04	41.81	80 EC 5758 8/31/80 7/13/81 14975
ELEVATOR ✓		46	44	17.07	92	04	53.11	80 EC 5758 8/31/80 7/13/81 14975

4-635(85)

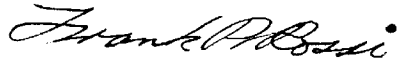
J. APPROVAL SHEET

APPROVAL

Supervision of all field and office work on this hydrographic survey was continuous and on a day to day basis to ensure completeness.

All work was done in accordance with the Project Instructions and the Hydrographic Manual. This survey ^{with exceptions noted in the E.R.} is complete and adequate for charting purposes. ~~conclude~~

Approved/Forwarded



FRANK P. ROSSI
CDR, NOAA
Commanding Officer, NOAA Ship WHITING

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SURVEY

WATER LEVEL NOTE FOR HYDROGRAPHIC SHEET

Processing Division: Atlantic Marine Center: CAM3

Hourly heights are approved for

Water Level Station Used: Duluth, Minnesota (909-9064)

Period: May 28, 1981 - October 13, 1981

HYDROGRAPHIC SHEET: H-9953

OPR- 2137-WH-81

Locality: Lake Superior

Plane of reference: Low Water Datum (IGLD 1955 : 600.0 Feet)

Remarks: Zoning not required. Data from other gages on Lake Superior indicated no unusual water level movement during the survey period.

Philip A. Morris
Chief, Water Level Branch 1-25-8

H-9953

GEOGRAPHIC NAMES

Name on Survey	Source of Information											No.
	A	B	C	D	E	F	G	H	K			
	ON CHART NO.	ON PREVIOUS SURVEY NO.	ON U.S. QUADRANGLE MAPS	FROM LOCAL INFORMATION	ON LOCAL MAPS	P.O. GUIDE OR MAP	RAND McNALLY ATLAS	U.S. LIGHT LIST				
CONNORS POINT ✓												1
DULUTH ✓												2
DULUTH HARBOR BASIN												3
DULUTH SHIP CANAL ✓												4
EAST GATE BASIN ✓												5
HEARDING ISLAND ✓												6
HOWARDS BAY ✓												7
LAKE SUPERIOR ✓												8
MINNESOTA (title) ✓												9
MINNESOTA POINT ✓												10
RICES POINT ✓												11
SUPERIOR ✓												12
SUPERIOR BAY ✓												13
TOWER BAY SLIP ✓												14
WEST GATE BASIN ✓												15
WISCONSIN (title)												16
												17
												18
												19
											Approved:	20
												21
											<i>Charles E. Harrington</i>	22
											Chief Geographer - N/CG2x5	23
											JUN 13 1985	24
												25

ATLANTIC MARINE CENTER
EVALUATION REPORT

REGISTRY NO.: H-9953

FIELD NO.: WH-5-1-81

Wisconsin--Minnesota, Lake Superior, Duluth Harbor Basin to East Gate Basin

SURVEYED: May 27 to October 13, 1981

SCALE: 1:5,000

PROJECT NO.: OPR-Z137-WH-81

SOUNDINGS: Ross Model 5000 Fineline and
Raytheon Model DE719B Echo
Sounders, and Hand Lead

CONTROL: Range/Azimuth
Del Norte Transponders/
Wild T-2 Theodolite, and
"See Boat Sheet" method

Chief of Party F. P. Rossi
Surveyed by W. T. Dewhurst
..... D. K. Howard
..... D. A. Bland
..... J. Zabitchuck
..... E. A. Steigerwald
..... P. J. Ruiz
..... L. R. Noyes
Automated Plot by Xynetics 1201 Plotter

1. INTRODUCTION

- a. Problems encountered during office processing are addressed in this report.
- b. Notes in red were appended to Descriptive Report items during office processing.

2. CONTROL AND SHORELINE

- a. Control is adequately addressed in sections F and G of the Descriptive Report.
- b. Shoreline is from final reviewed Class I shoreline photogrammetric manuscripts TP-01078, TP-01081, and TP-01082 of 1980-81.

3. HYDROGRAPHY

- a. Depths at crossings are in agreement.

b. Bottom coverage and delineation of the depth curves is adequate except in low water areas where, frequently, there are no soundings with which to delineate the low water curves. Depth curves were compiled using all sounding levels, the smooth sheet, and excess sounding levels 1, 2, and 3.

4. CONDITION OF SURVEY

The smooth sheet and accompanying overlays, hydrographic records, and reports are adequate and conform to the requirements of the project instructions and Hydrographic Manual with the following exceptions:

a. There is no hydrographic evidence that Class III photogrammetric manuscript information transferred to the field sheets was verified at the time of the survey. This information is shown on the field sheets in blue ink.

b. Elevations on landmarks were not acquired.

c. Verification or disproval of charted features such as ruins, piles, and dolphins, when not appearing on the contemporary shoreline maps, was generally ignored during the survey. These items are individually addressed in Section 7, "Comparison with Chart," in this report.

d. Some position numbers were duplicated.

e. Presurvey Review items were not identified with their geographic positions when addressed in the Descriptive Report. Geographic positions were appended during office processing.

f. The acquisition of bottom samples was excessive.

g. Hydrography on the edges of the survey was not squared. Excessive junctional overlap is noted on the south with H-10023 (1982) and on the east with H-9960 (1981).

h. The entries of survey information in the sounding volumes were both confusing and contrary to normal procedure. Blocks of position numbers entered in the sounding volumes were not in numerical order and were occasionally not listed on the cover of the sounding volume. Also, data from different vessels were entered in the same sounding volume.

i. The positions of items shown on the contemporary shoreline maps when located with range/azimuth detached positions on the survey are in conflict. This problem was not addressed by the hydrographer. In all cases, these items are shown on the smooth sheet as they are shown on the shoreline maps.

j. Numerous problems were encountered in verification during the processing of this survey. Several velocity and TRA correctors were revised and reapplied.

k. Duluth Harbor Basin, Northern Section and Southern Section, East Gate Basin, and West Gate Basin are the responsibility of, and routinely surveyed

by, the Corps of Engineers. Generally, the portion of the survey covering these areas is presently superseded by subsequent Corps of Engineers surveys.

5. JUNCTIONS

H-10024 (1982) to the north
H-9960 (1981) to the east
H-10023 (1982) to the south

The junctions with H-10024 (1982) and H-9960 (1981) are adequate. The junction with H-10023 (1982) will be addressed in the evaluation of that survey.

6. COMPARISON WITH PRIOR SURVEYS

LS-251 (1861) 1:16,000
LS-257 (1861) 1:60,000
LS-1829 (1944) 1:15,000

These prior surveys cover the present survey area in its entirety.

Surveys LS-251 and LS-257 of 1861 have no geographic projections. This, plus significant cultural change since 1861, negates any meaningful comparison between the present and prior surveys. These early surveys serve only as historical documents.

Present survey depths are generally 1 to 3 feet shoaler than those shown on LS-1829 (1944).

The present survey is adequate to supersede the prior surveys within the common area.

7. COMPARISON WITH CHART 14975, 26th Edition, April 26, 1980

a. Hydrography

The charted hydrography originates with the previously discussed prior surveys and miscellaneous sources. Differences between prior and present depths of plus or minus 1 to 3 feet are common. The area centered in latitude 46°45.85'N, longitude 92°04.50'W has apparently undergone the greatest change. Present survey depths in this area are 3 to 10 feet deeper than charted depths.

b. Features extending seaward from the shoreline or falling in water

(1) The three cribs charted from LS-1829 (1944) in latitude 46°47.80'N, longitude 92°05.55'W are in fact two dolphins and a crib. Their positions and labels should be charted as shown on TP-01078 (1980-81).

(2) The three piles charted from a miscellaneous source in latitude 46°46.81'N, longitude 92°05.68'W are considered to have been removed when the present bulkhead was built. Chart area as shown on the present survey.

(3) The bulkhead ruins charted from a miscellaneous source in latitude $46^{\circ}46.35'N$, longitude $92^{\circ}06.54'W$ are considered to have been removed when the adjacent land area was dredged. Chart area as shown on the present survey.

(4) The bulkhead ruins charted from a miscellaneous source in latitude $46^{\circ}46.14'N$, longitude $92^{\circ}06.66'W$ were not investigated on the present survey and, unless the compiler has information to the contrary, should be charted as submerged ruins.

(5) The row of piles (four solid circles), considered the remains of a former bulkhead, charted from a miscellaneous source in latitude $46^{\circ}46.24'N$, longitude $92^{\circ}06.24'W$ fall offshore of bulkhead ruins shown on the present survey. These items were not investigated on the present survey and, unless the compiler has information to the contrary, should be charted with a dashed line indicating submerged ruins.

(6) The eight piles, considered to be the remains of a former bulkhead, charted from a miscellaneous source in latitude $46^{\circ}46.18'N$, longitude $92^{\circ}06.38'W$ were not investigated on the present survey and, unless the compiler has information to the contrary, should be charted with a dashed line indicating submerged ruins.

(7) The ramp charted from a miscellaneous source in latitude $46^{\circ}45.13'N$, longitude $92^{\circ}06.20'W$ is considered to no longer exist because of shoreline change in this area. Expunge the charted ramp.

(8) The two piles charted from a miscellaneous source in latitude $46^{\circ}45.16'N$, longitude $92^{\circ}06.34'W$ were not investigated on the present survey and, unless the compiler has information to the contrary, should be charted as submerged piles.

(9) The charted delineation of submerged cables around the swing bridge located in latitude $46^{\circ}45.13'N$, longitude $92^{\circ}06.45'W$ is in conflict with the delineation of submerged cables shown on TP-01081 (1980-81). Chart the submerged cables as shown on TP-01081 (1980-81).

(10) The ruins of a former bulkhead charted from a miscellaneous source in latitude $46^{\circ}44.73'N$, longitude $92^{\circ}06.35'W$ are considered to be erroneously positioned on the chart. Chart the bulkhead ruins as shown on the present survey.

(11) The three piles charted from a miscellaneous source in latitude $46^{\circ}44.28'N$, longitude $92^{\circ}06.24'W$ are probably part of the bulkhead ruins shown nearby on the present survey. Chart the area as shown on the present survey.

(12) The three piles charted from a miscellaneous source in latitude $46^{\circ}44.22'N$, longitude $92^{\circ}06.26'W$ are probably part of the bulkhead ruins shown on the present survey. Chart the area as shown on the present survey.

(13) The three piles charted from a miscellaneous source in latitude $46^{\circ}44.58'N$, longitude $92^{\circ}06.06'W$ were not investigated on the present survey.

Unless the compiler has information to the contrary, these items should be charted as submerged piles.

(14) The ruins of a former bulkhead charted from a miscellaneous source and centered in latitude $46^{\circ}44.80'N$, longitude $92^{\circ}05.75'W$ (northeast foreshore of Connors Point) should be charted as shown on the present survey.

(15) The low water curve charted in the area of latitude $46^{\circ}46.15'N$, longitude $92^{\circ}05.40'W$ from a miscellaneous source is partially disproved by present survey depths. Part of this curve falls in an area of no development. A charting resolution concerning this portion of the low water curve is deferred to the chart compiler.

(16) The charted channel encompassing three sides of Hearing Island in the vicinity of latitude $46^{\circ}45.60'N$, longitude $92^{\circ}04.93'W$ apparently was dredged to a controlling depth of 3 or 4 feet. Shoreline accretion on the southeast point of Hearing Island indicates the channel is closed. Hydrographic development is inadequate to determine a controlling depth of this small channel.

c. Controlling Depths

(1) Tabulated controlling depths and present survey depths in Duluth Ship Canal are superseded by Corps of Engineers surveys of October 1982. (See Chart 14975, 27th Edition, dated 4/16/83.)

(2) There are no conflicts between present survey depths and tabulated controlling depths in Duluth Harbor Basin, Northern Section and Southern Section.

(3) In East Gate Basin shoaler present survey depths are noted: 23 feet in the Left Outside Quarter versus tabulated 25-foot depths; 25 feet in the Right Inside Quarter versus tabulated 25.6-foot depths; 23 feet in the Right Outside Quarter versus tabulated 25.5-foot depths. There are no shoaler depths noted in the Left Inside Quarters.

(4) Tabulated controlling depths and present survey depths in West Gate Basin are superseded by Corps of Engineers surveys of November 1981. (See Chart 14975, 27th Edition, dated 4/16/83.)

(5) Tabulated controlling depths and present survey depths in Howards Bay are superseded by Corps of Engineers surveys of February 1982. (See Chart 14975, 27th Edition, dated 4/16/83.)

(6) Tabulated controlling depths and present surveys depths in North Channel, Eastern Section are superseded by Corps of Engineers surveys of November 1981. (See Chart 14975, 27th Edition, dated 4/16/83.)

d. Aids to Navigation

(1) The floating aids to navigation were located and adequately mark their intended features with the following exceptions:

(a) The red nun buoy number 2 charted in latitude 46°47.25'N, longitude 92°05.37'W and marking the offshore end of submerged ruins was located approximately 50 meters north of the end of the ruins and does not now adequately mark the offshore end of the feature.

(b) The charted positions of privately maintained seasonal buoys 1, 2, 4, and 6 marking the entrance to the Hearing Island Channel in the vicinity of latitude 46°45.74'N, longitude 92°05.15'W are in conflict with present survey positions of these aids. The buoys adequately mark the channel entrance.

(c) The two privately maintained orange and white buoys located in latitude 46°45'52"N, longitude 92°04'14"W and latitude 46°46'42"N, longitude 92°05'08"W on the present survey are not charted and were not found in the U.S. Coast Guard Light List of 1982. Their purpose was not determined on the survey. A charting resolution is deferred to the chart compiler.

(d) Charted lighted buoys "18" and "19" located in latitude 46°44.51'N, longitude 92°04.94'W and latitude 46°44.53'N, longitude 92°05.19'W, respectively, were not located on the present survey but were located on junctional survey H-10023 (1982) and should be retained as charted.

(2) Fixed aids to navigation and landmarks

Several positional conflicts between the chart and the survey were noted during evaluation. See the 76-40 forms inserted in the Descriptive Report for accurate positional data and charting recommendations concerning these items.

e. Synopsis of Chart Comparison

In addition to items addressed in sections 7.b.1 through 7.b.15, a comparison of charted information revealed numerous positional conflicts that are not individually addressed in this report. Shoreline because of natural and cultural change and positional inaccuracy should be recompiled. Generally the positions of fixed aids, landmarks, and offshore features need revision. Multiple positional conflicts, bottom change, and the fact that the chart is based on a 1902 horizontal datum indicate that a complete chart reconstruction based on the North American Datum of 1983 is needed. Chart information is superseded by the present survey with exceptions noted in this report.

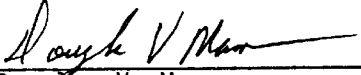
The symbolization of rocks on the contemporary shoreline maps and counterpart rocks on the smooth sheet are in conflict. The smooth sheet portrayal follows the conventions shown in figure B-3 of the Hydrographic Manual. Rocks with elevations greater than 4.3 feet (5) are shown on the smooth sheet as bare rocks with elevations in red ink. Rocks with elevations less than 4.3 feet are shown on the smooth sheet by the "rock awash" symbol with elevations in black ink. Underlined elevations on features that cover and uncover at some stage of the water level are not used on Great Lakes surveys.

8. COMPLIANCE WITH INSTRUCTIONS

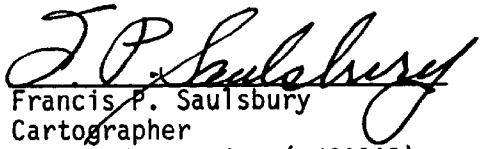
This survey adequately complies with the project instructions, except as noted in sections 4 and 7 of this report.

9. ADDITIONAL FIELD WORK

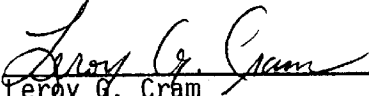
This is an adequate basic survey and no additional field work is recommended.



Douglas V. Mason
Cartographic Technician
Verification of Field Data



Francis P. Saulsbury
Cartographer
Standards Section (N/CG242)
Evaluation and Analysis

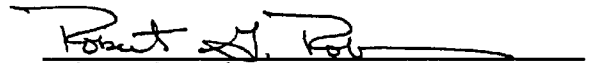


Leroy G. Cram
Supervisory Cartographic Technician
Verification Check

Certification of Digital Data
H-9953

The digital data have been completed and all revisions and additions made to the smooth sheet during survey processing have been entered in the magnetic tape record for this survey. Final control, position, sounding and digitized data printouts of the survey have been made.


Certified: 17 September 1985


Robert G. Roberson
Chief, Evaluation and Analysis Group

Inspection Report
H-9953

The completed survey has been inspected with regard to survey coverage, delineation of depth curves, development of critical depths, cartographic symbolization, and verification or disproof of charted data. The survey complies with National Ocean Service (NOS) requirements except as noted in the Evaluation Report. The survey records comply with NOS requirements except where noted in the Evaluation Report.

Inspected


George K. Myers
Chief, Standards Section (N/CG242)
Hydrographic Surveys Branch

Approved


Wesley V. Hull, RADM, NOAA
Director, Atlantic Marine Center

MARINE CHART BRANCH
RECORD OF APPLICATION TO CHARTS

FILE WITH DESCRIPTIVE REPORT OF SURVEY NO. H-9953

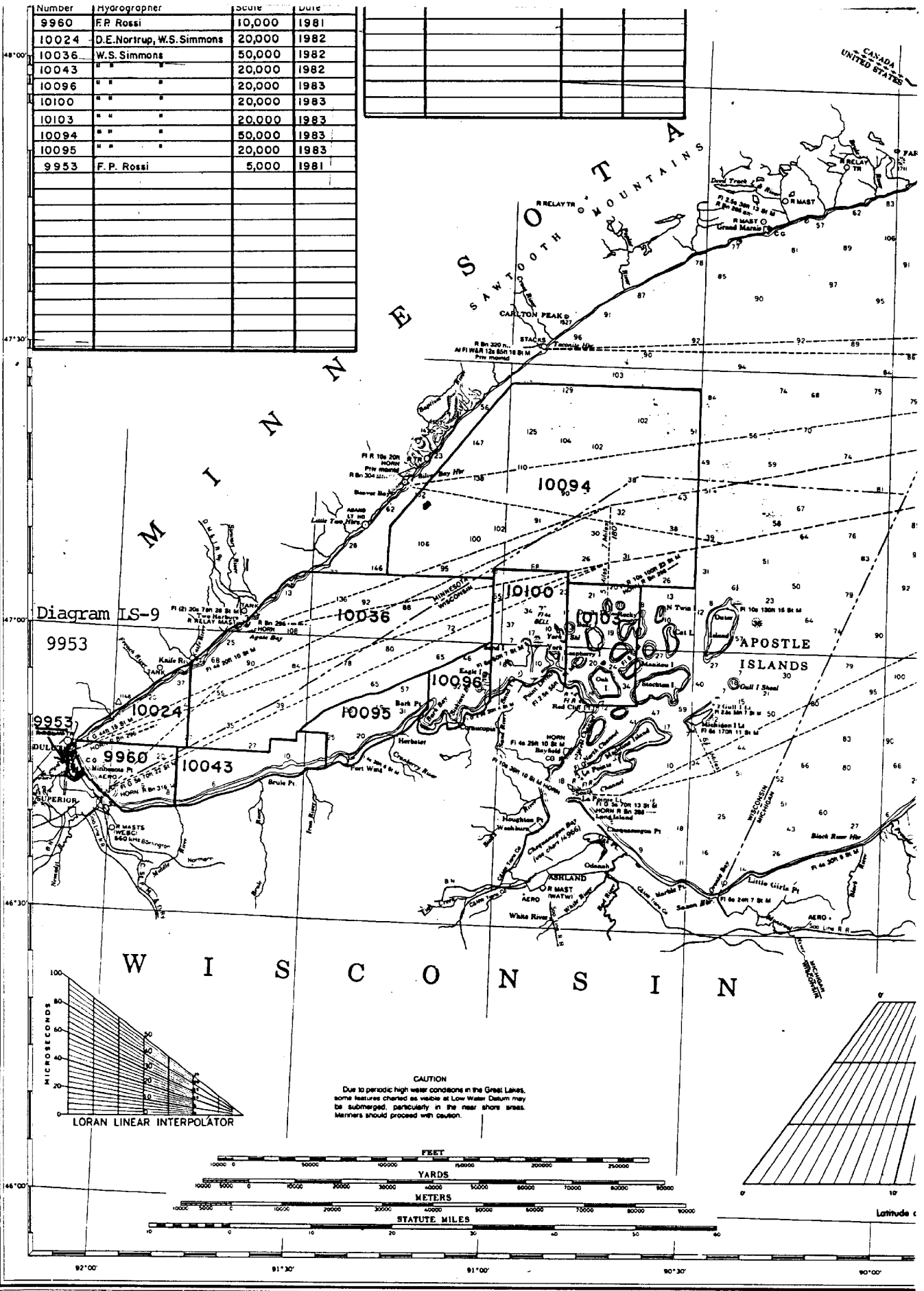
INSTRUCTIONS

A basic hydrographic or topographic survey supersedes all information of like nature on the uncorrected chart.

- 1. Letter all information.
- 2. In "Remarks" column cross out words that do not apply.
- 3. Give reasons for deviations, if any, from recommendations made under "Comparison with Charts" in the Review.

CHART	DATE	CARTOGRAPHER	REMARKS
14966	12-4-85	Russell P Kennedy	Full Part Before After Marine Center Approval Signed Via Drawing No. 4 Consider fully appl pending application
14975	7-16-87	J. Pincove	Full Part Before After Marine Center Approval Signed Via Drawing No. 4 to 14975
14960	8-14-87	J. Pincove	Full Part Before After Marine Center Approval Signed Via Drawing No. 5 Applied in full thru 14966-14975
14961	8-14-87	J. Pincove	Full Part Before After Marine Center Approval Signed Via Drawing No. 5 Applied in full thru 14966-14975
14500	8-25-87	Russell P Kennedy	Full Part Before After Marine Center Approval Signed Via Drawing No. 4 Forward to next edition at proof.
14500	4-5-94	William J. Orr	Full Part Before After Marine Center Approval Signed Via Drawing No. 5 N.C. Scale
			Full Part Before After Marine Center Approval Signed Via Drawing No.
			Full Part Before After Marine Center Approval Signed Via Drawing No.
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Number	Hydrographer	Scale	Date
9960	F.P. Rossi	10,000	1981
10024	D.E. Nortrup, W.S. Simmons	20,000	1982
10036	W.S. Simmons	50,000	1982
10043	"	20,000	1982
10096	"	20,000	1983
10100	"	20,000	1983
10103	"	20,000	1983
10094	"	50,000	1983
10095	"	20,000	1983
9953	F. P. Rossi	5,000	1981



LS-9