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SUSITNA
HYDROELECTRIC PROJECT

FEDERAL ENERGY REGULATORY COMMISSION
PROJECT No. 7114

RESERVOIR/RIVER TEMPERATURES AND ICE SIMULATIONS

FOR WATANA AND DEVIL CANYON OPERATING IN 2002

VOLUME 6 - APPENDIX H

Final Report

February 1985
Document No. 2605

HARZA-EBASCO
SUSITNA JOINT VENTURE

ALASKA POWER AUTHORITY

Document No. 2605
Susitna File No. 6.18.7.5

SUSITNA HYDROELECTRIC PROJECT

RESERVOIR/RIVER TEMPERATURES AND ICE SIMULATIONS

For Watana And Devil Canyon Operating In 2002

VOLUME 6 - APPENDIX H

Report By
Harza-Ebasco Susitna Joint Venture

Prepared for
Alaska Power Authority

Final Report
February 1985

Appendix H

SUSITNA HYDROELECTRIC PROJECT

Reservoir/River Temperature and Ice Simulations

For Watana and Devil Canyon Operating, 2002

o Exhibits (8)

Appendix H

SUSITNA HYDROELECTRIC PROJECT

List of Exhibits

H-1 Case E-VI Reservoir Temperature Simulation, for Projected Energy Demands - Year 2002

H-2 Case C Reservoir Temperature Simulations for Projected Energy Demands - Year 2002

H-3 Case E-VI River Temperature Simulations for Projected Energy Demands - Year 2002

H-4 Case C River Temperature Simulations for Projected Energy Demands - Year 2002

H-5 A comparison of Simulated River Temperatures at River Miles 100, 130 and 150 for Case C and Case E-VI Flow Requirements

H-6 Case E-VI River Ice Simulations for Projected Energy Demands - Year 2002

H-7 Case C River Ice Simuilations for Projected Energy Demands - Year 2002

H-8 A comparison of River Ice Simulations for Case C and Case E-VI Flow Requirements, Projected Energy Demands for Year 2002

Exhibit H-1

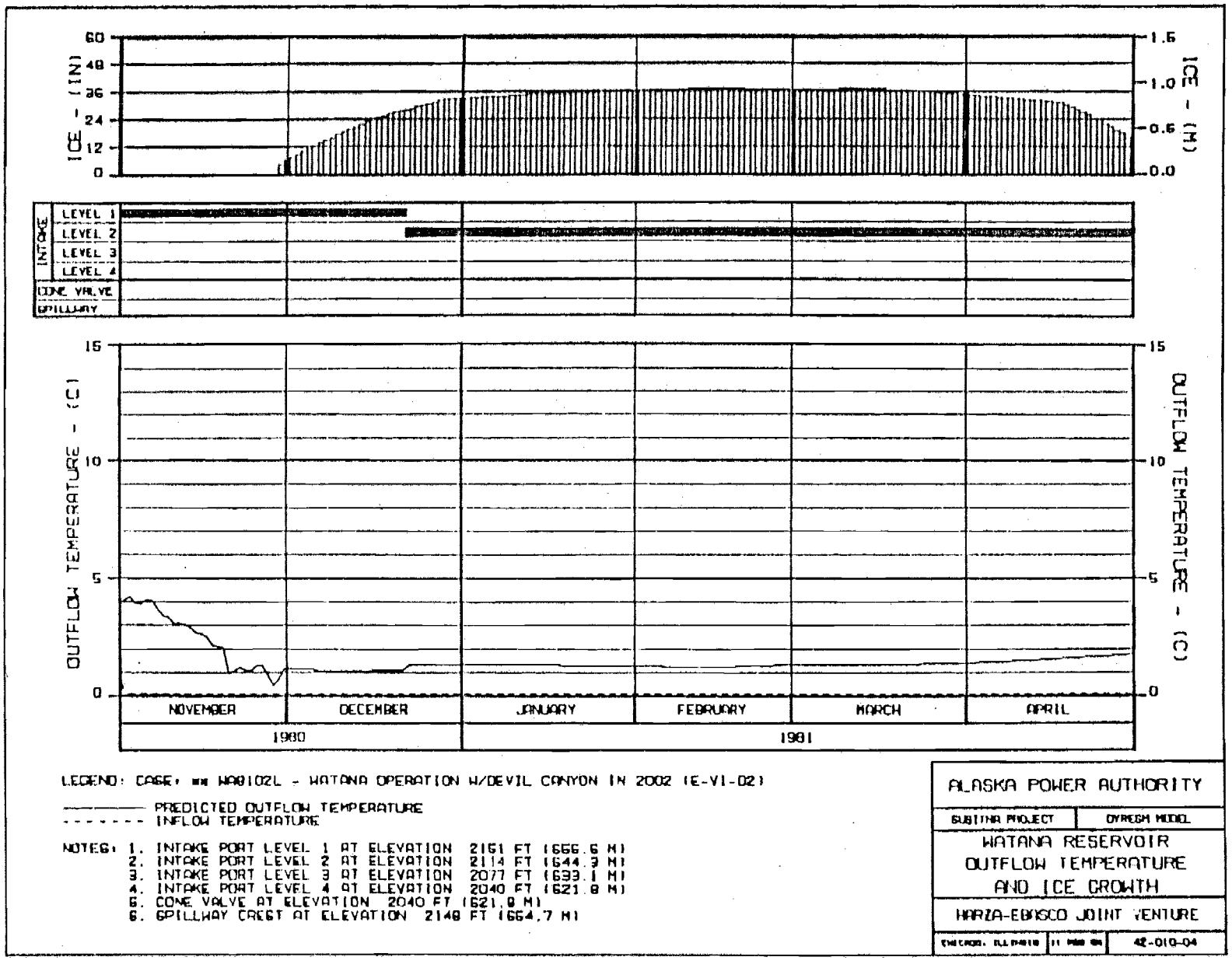
CASE E-VI RESERVOIR TEMPERATURE SIMULATIONS

FOR

PROJECTED ENERGY DEMANDS - YEAR 2002

- o Outflow Temperature and Ice Growth Curves
- o Temperature Profiles

Note: Simulations are based on hydrologic and meteorologic data from the period November 1980 to September 1982.



LEGEND: CASE: WA01021 - WATANA OPERATION W/DEVIL CANYON IN 2002 (E-VI-02)

———— PREDICTED OUTFLOW TEMPERATURE
- - - - - - - INFLOW TEMPERATURE

NOTES: 1. INTAKE PORT LEVEL 1 AT ELEVATION 2151 FT (656.6 M)
2. INTAKE PORT LEVEL 2 AT ELEVATION 2114 FT (644.3 M)
3. INTAKE PORT LEVEL 3 AT ELEVATION 2077 FT (633.1 M)
4. INTAKE PORT LEVEL 4 AT ELEVATION 2040 FT (621.8 M)
5. CONE VALVE AT ELEVATION 2040 FT (621.8 M)
6. SPILLWAY CREST AT ELEVATION 2148 FT (654.7 M)

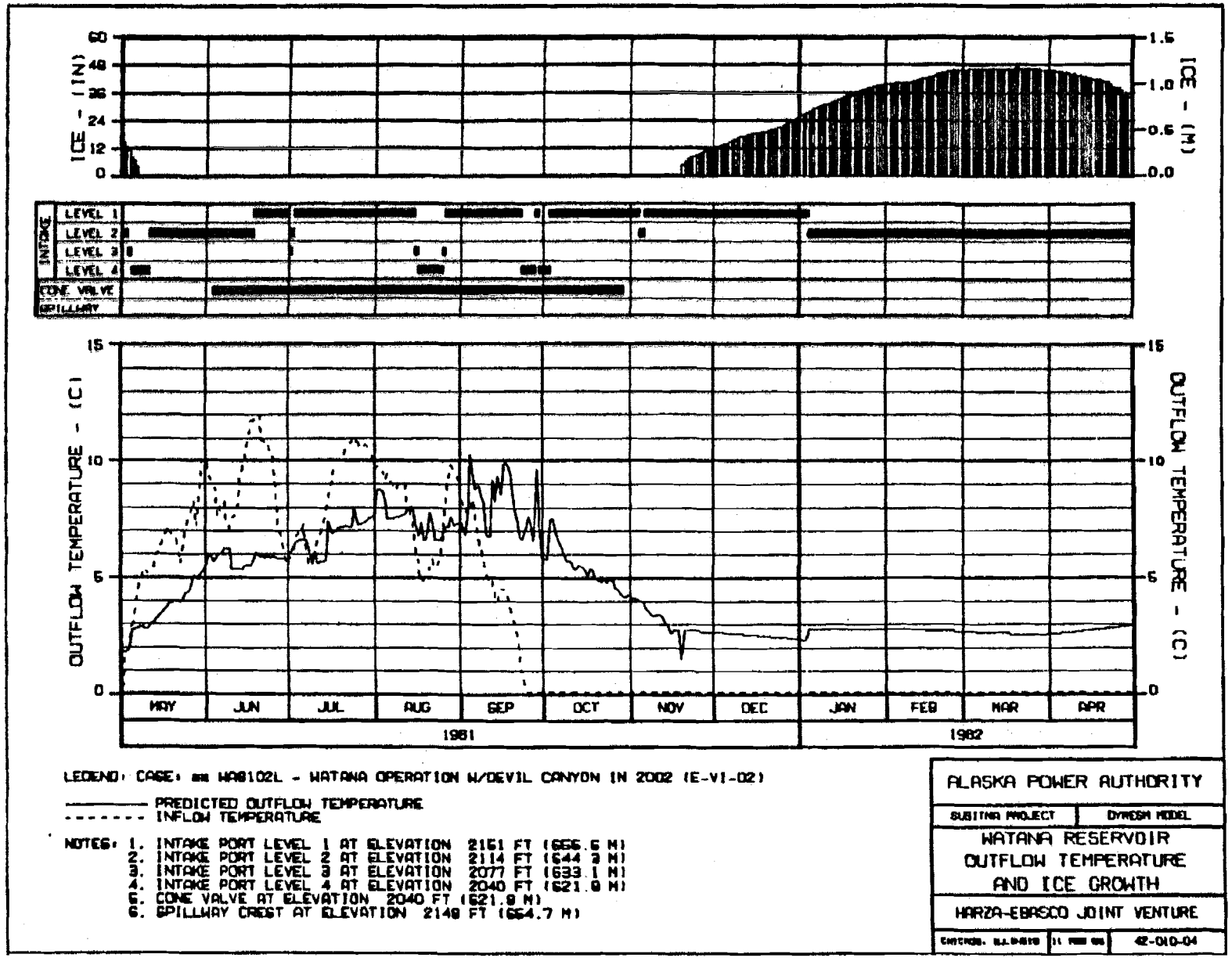
ALASKA POWER AUTHORITY

SUSITNA PROJECT | DYRESM MODEL

WATANA RESERVOIR
OUTFLOW TEMPERATURE
AND ICE GROWTH

HARZA-EBASCO JOINT VENTURE

42-010-04



LEGEND: CASE: as WA8102L - WATANA OPERATION W/DEVIL CANYON IN 2002 (E-VI-02)

——— PREDICTED OUTFLOW TEMPERATURE
- - - - - - - INFLOW TEMPERATURE

NOTES: 1. INTAKE PORT LEVEL 1 AT ELEVATION 2151 FT (655.6 M)
2. INTAKE PORT LEVEL 2 AT ELEVATION 2114 FT (644 3 M)
3. INTAKE PORT LEVEL 3 AT ELEVATION 2077 FT (633.1 M)
4. INTAKE PORT LEVEL 4 AT ELEVATION 2040 FT (621.9 M)
5. CONE VALVE AT ELEVATION 2040 FT (621.9 M)
6. SPILLWAY CREST AT ELEVATION 2149 FT (654.7 M)

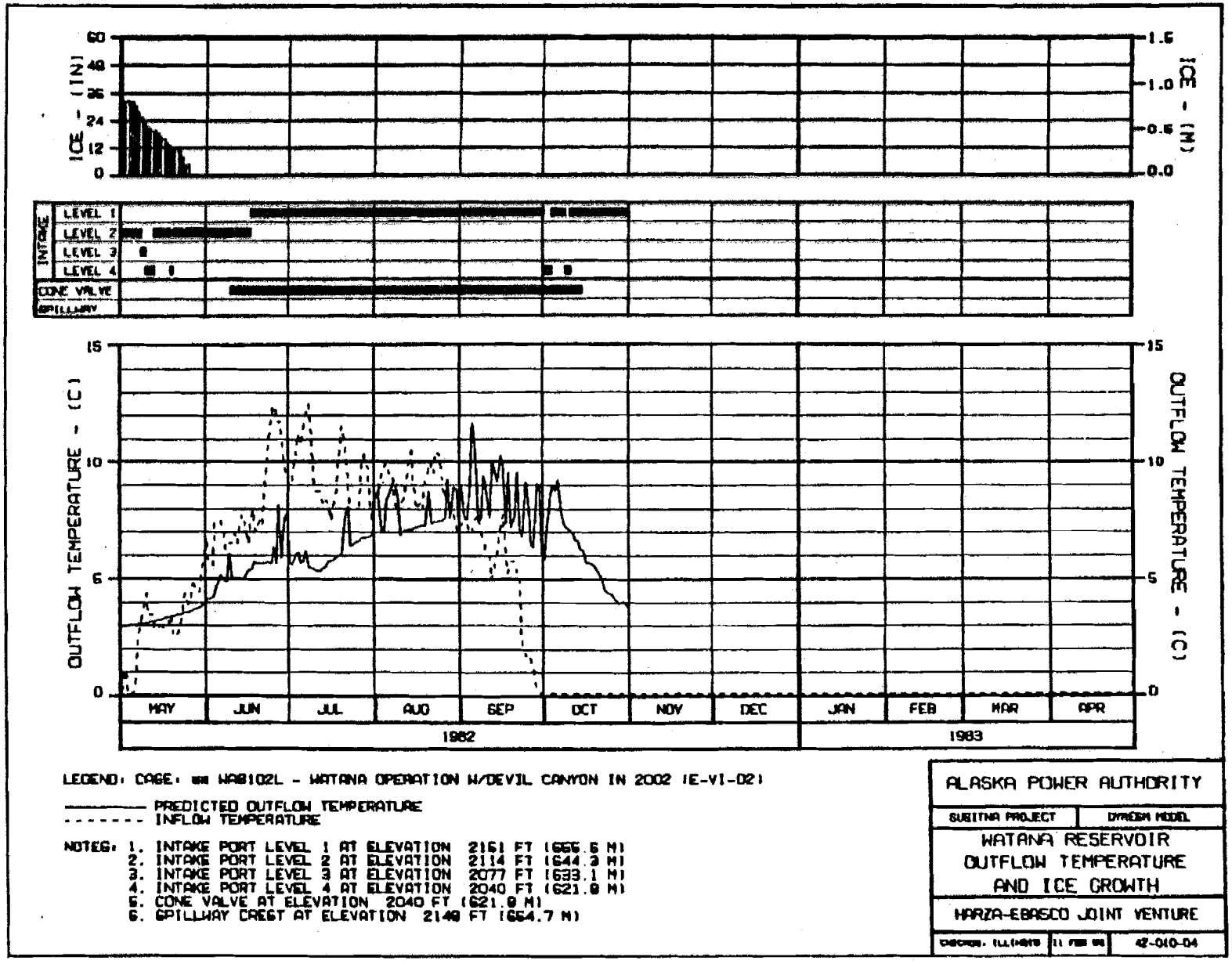
ALASKA POWER AUTHORITY

SUSITNA PROJECT	DYNESM MODEL

WATANA RESERVOIR
OUTFLOW TEMPERATURE
AND ICE GROWTH

HARZA-EBASCO JOINT VENTURE

		42-010-04



LEGEND: CASE: WA8102L - WATANA OPERATION W/DEVIL CANYON IN 2002 (E-V1-02)

———— PREDICTED OUTFLOW TEMPERATURE
- - - - - - - INFLOW TEMPERATURE

NOTES: 1. INTAKE PORT LEVEL 1 AT ELEVATION 2161 FT (665.6 M)
2. INTAKE PORT LEVEL 2 AT ELEVATION 2114 FT (644.3 M)
3. INTAKE PORT LEVEL 3 AT ELEVATION 2077 FT (633.1 M)
4. INTAKE PORT LEVEL 4 AT ELEVATION 2040 FT (621.8 M)
5. CONE VALVE AT ELEVATION 2040 FT (621.8 M)
6. SPILLWAY CREST AT ELEVATION 2149 FT (654.7 M)

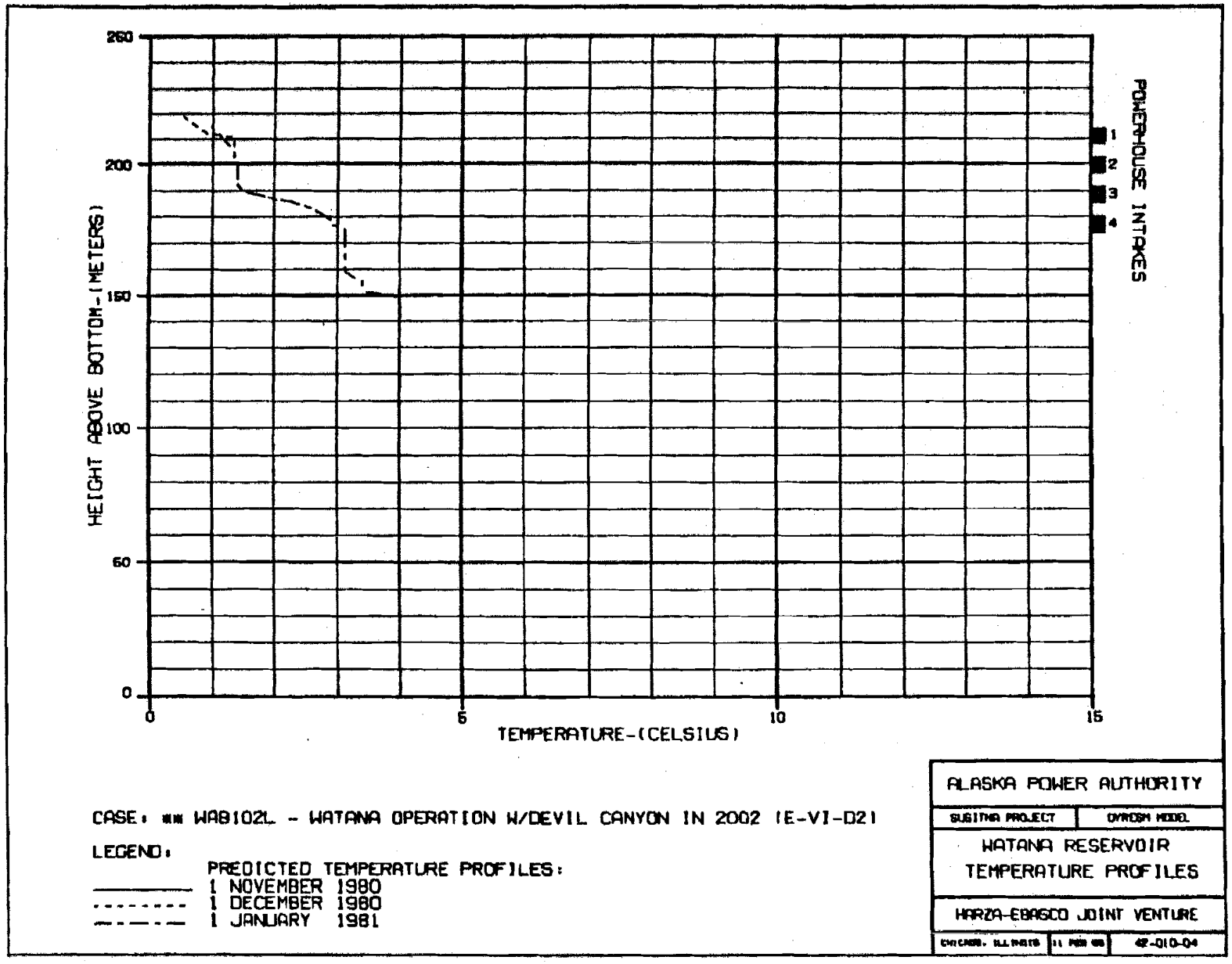
ALASKA POWER AUTHORITY

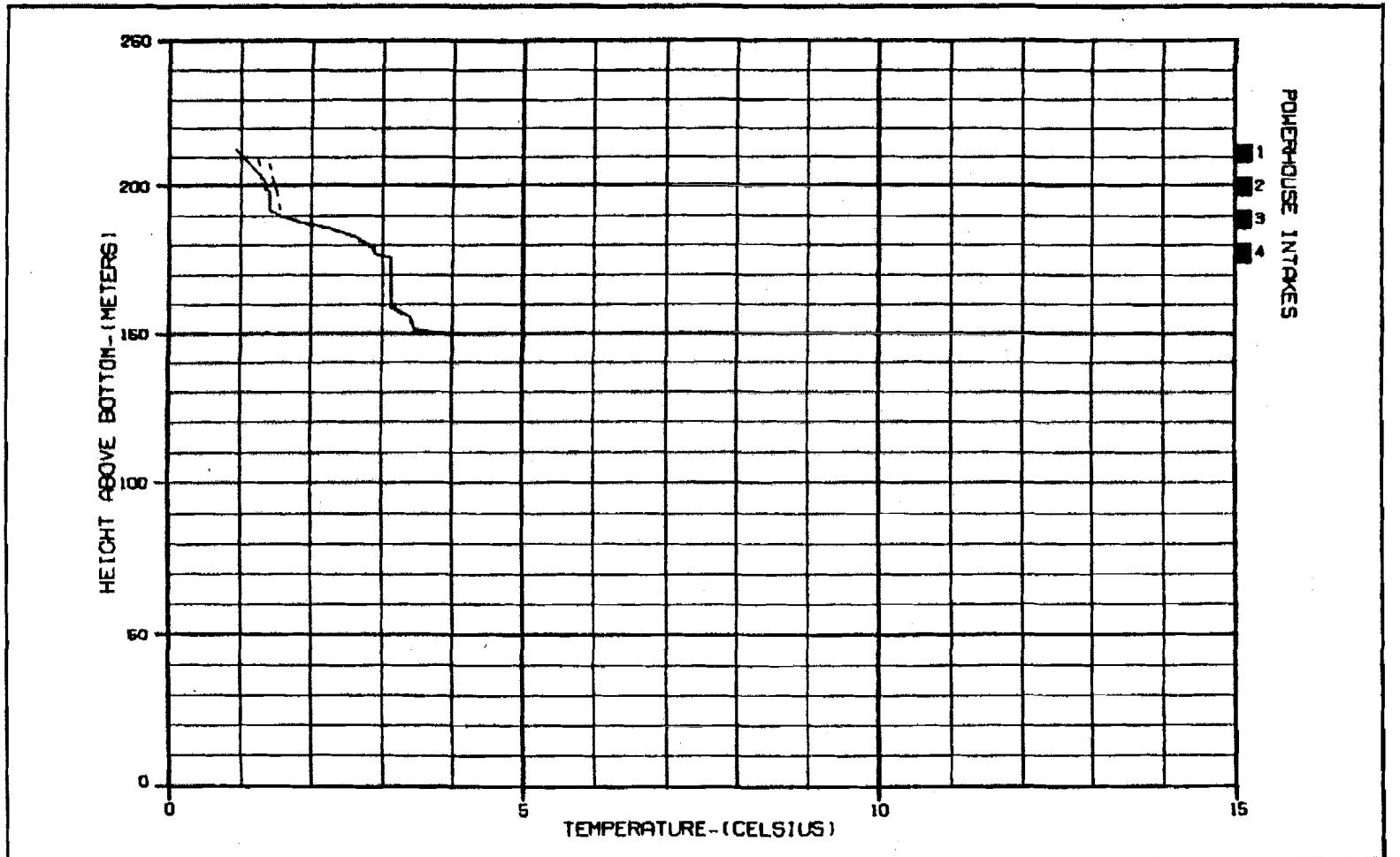
SUSITNA PROJECT | DYNSIM MODEL

WATANA RESERVOIR
OUTFLOW TEMPERATURE
AND ICE GROWTH

HARZA-EBASCO JOINT VENTURE

42-010-04


260
200
150
100
60
0
HEIGHT ABOVE BOTTOM-(METERS)
0
5
10
15
TEMPERATURE-(CELSIUS)
POWERHOUSE INTAKES
1
2
3
4
CASE: WA8102L - WATANA OPERATION W/DEVIL CANYON IN 2002 (E-VI-D2)
LEGEND:
PREDICTED TEMPERATURE PROFILES:
1 NOVEMBER 1980
1 DECEMBER 1980
1 JANUARY 1981
ALASKA POWER AUTHORITY
SUSITNA PROJECT
DYRESM MODEL
WATANA RESERVOIR
TEMPERATURE PROFILES
HARZA-EBASCO JOINT VENTURE



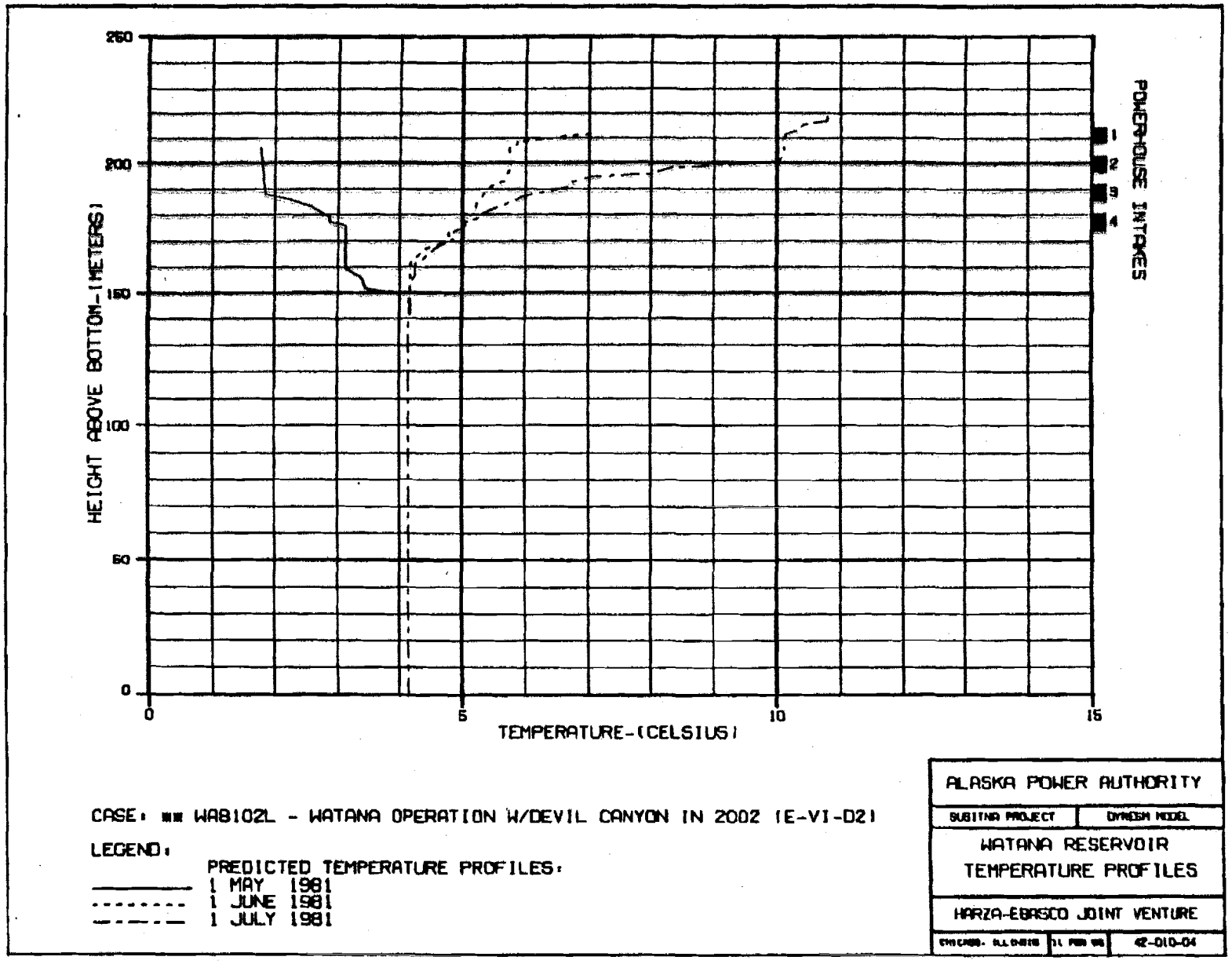
CASE: WAB102L - WATANA OPERATION W/DEVIL CANYON IN 2002 (E-VI-D2)

LEGEND:

PREDICTED TEMPERATURE PROFILES:

———— 1 FEBRUARY 1981
- - - - - - - - 1 MARCH 1981
—·—·—·— 1 APRIL 1981

ALASKA POWER AUTHORITY	
SUSITNA PROJECT	DYRESM MODEL
WATANA RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
[illegible]	42-010-04



CASE: WAB102L - WATANA OPERATION W/DEVIL CANYON IN 2002 (E-VI-D2)

LEGEND:

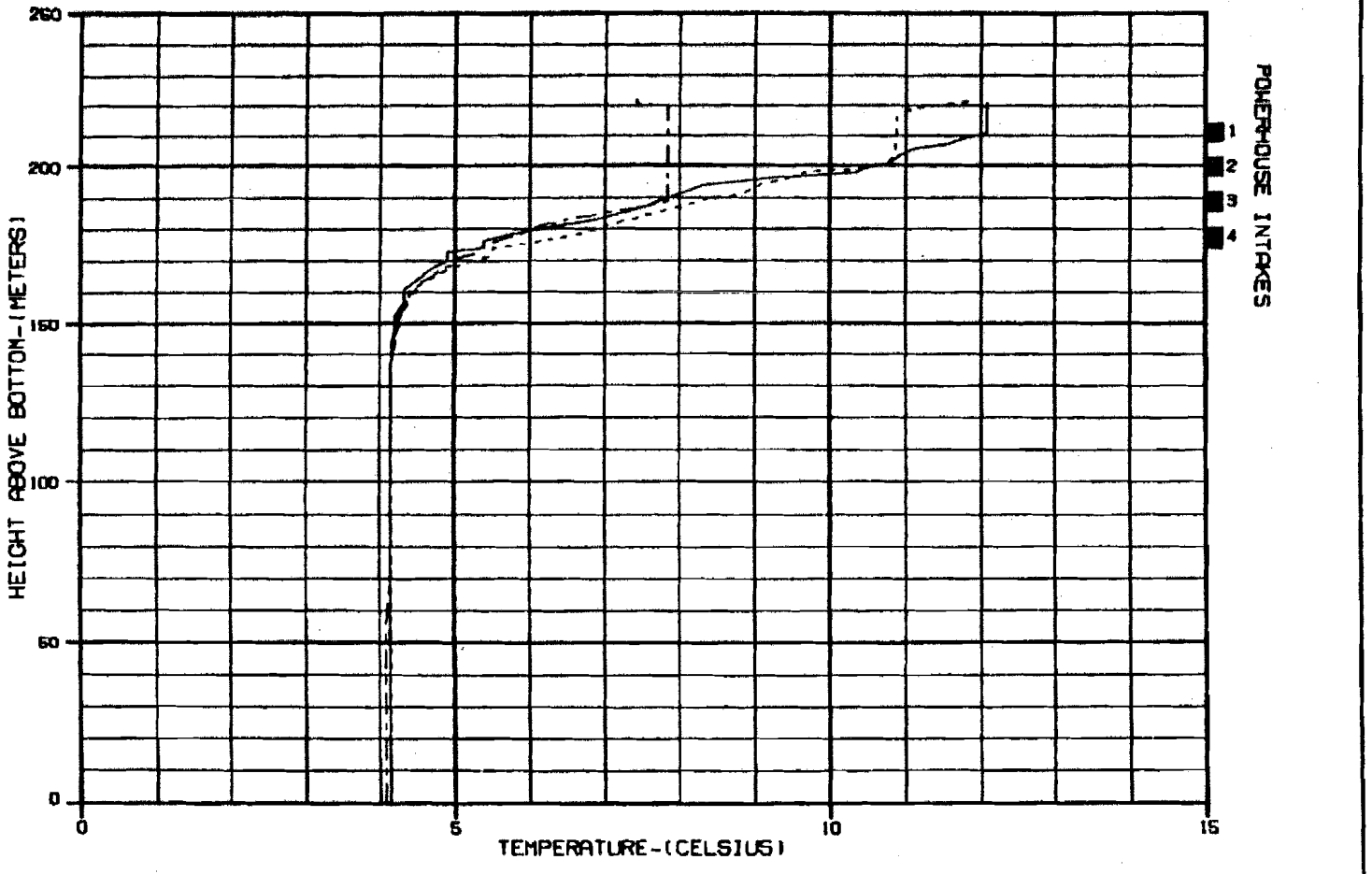
PREDICTED TEMPERATURE PROFILES:

———— 1 MAY 1981

- - - - - - - - 1 JUNE 1981

—·—·—·— 1 JULY 1981

ALASKA POWER AUTHORITY	
SUSITNA PROJECT	DYNSIM MODEL
WATANA RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
[illegible]	42-010-04



CASE: WABI02L - WATANA OPERATION W/DEVIL CANYON IN 2002 (E-V1-02)

LEGEND:

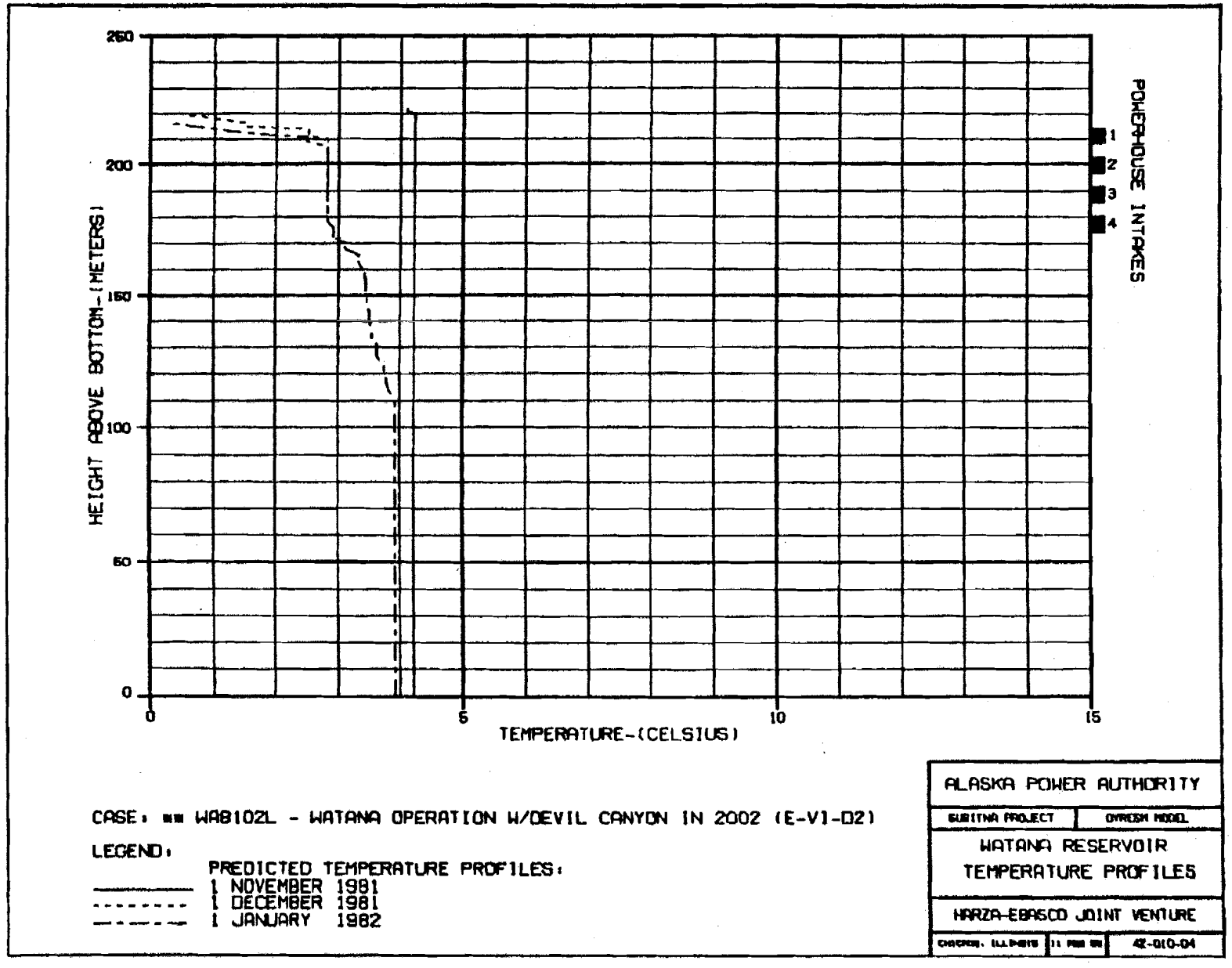
PREDICTED TEMPERATURE PROFILES:

———— 1 AUGUST 1981

- - - - - - - - 1 SEPTEMBER 1981

— — — — 1 OCTOBER 1981

ALASKA POWER AUTHORITY	
SUSITNA PROJECT	DYRESM MODEL
WATANA RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
CHICAGO, ILLINOIS	11 FEB 88	AE-010-04



CASE: WA8102L - WATANA OPERATION W/DEVIL CANYON IN 2002 (E-V1-D2)

LEGEND:

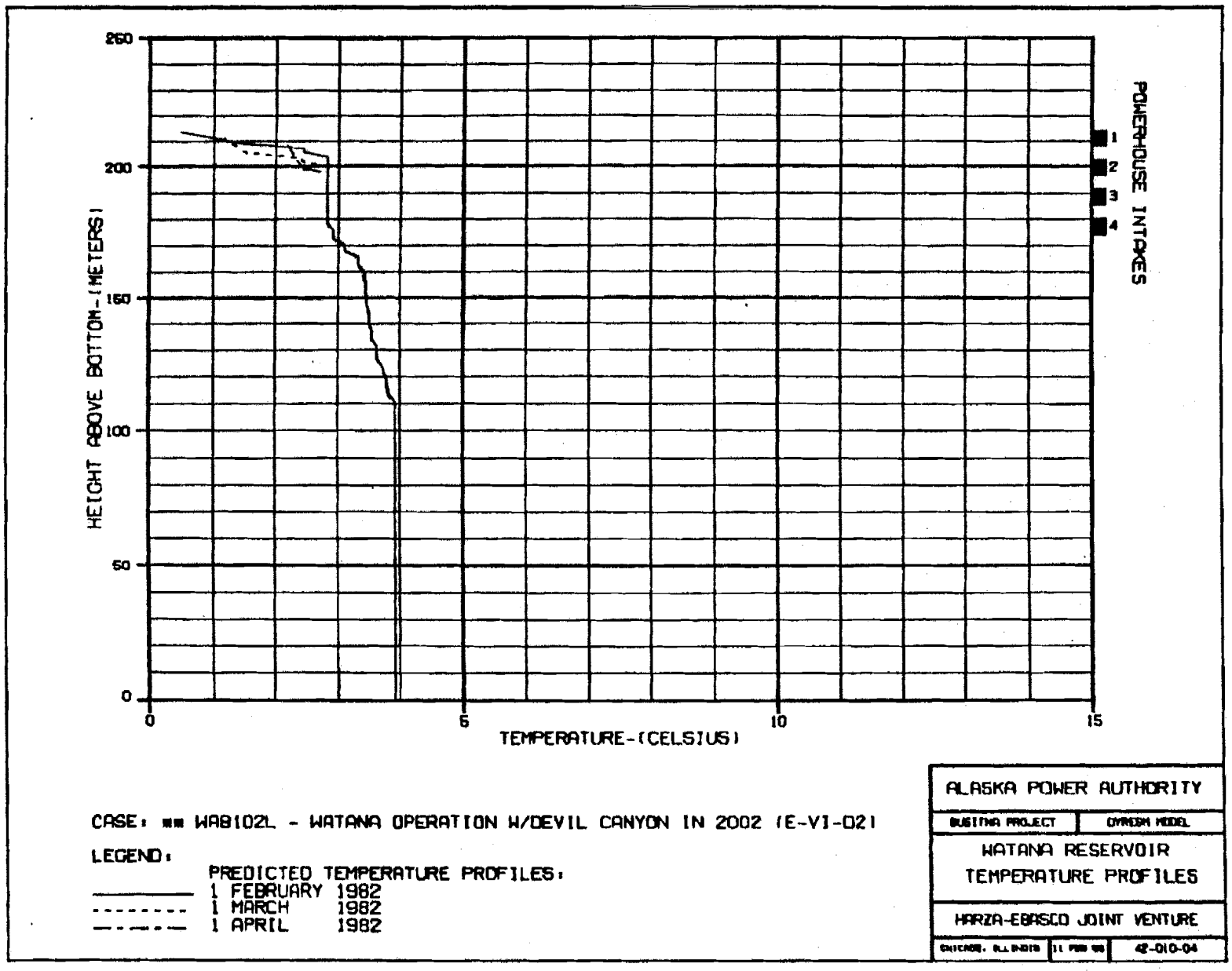
PREDICTED TEMPERATURE PROFILES:

———— 1 NOVEMBER 1981

- - - - - - - - 1 DECEMBER 1981

———— 1 JANUARY 1982

ALASKA POWER AUTHORITY	
SUSITNA PROJECT	DYRESM MODEL
WATANA RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
CHICAGO, ILLINOIS	42-010-04



CASE: WAB102L - WATANA OPERATION W/DEVIL CANYON IN 2002 (E-V1-02)

LEGEND:

PREDICTED TEMPERATURE PROFILES:

———— 1 FEBRUARY 1982

- - - - - - - - 1 MARCH 1982

———— 1 APRIL 1982

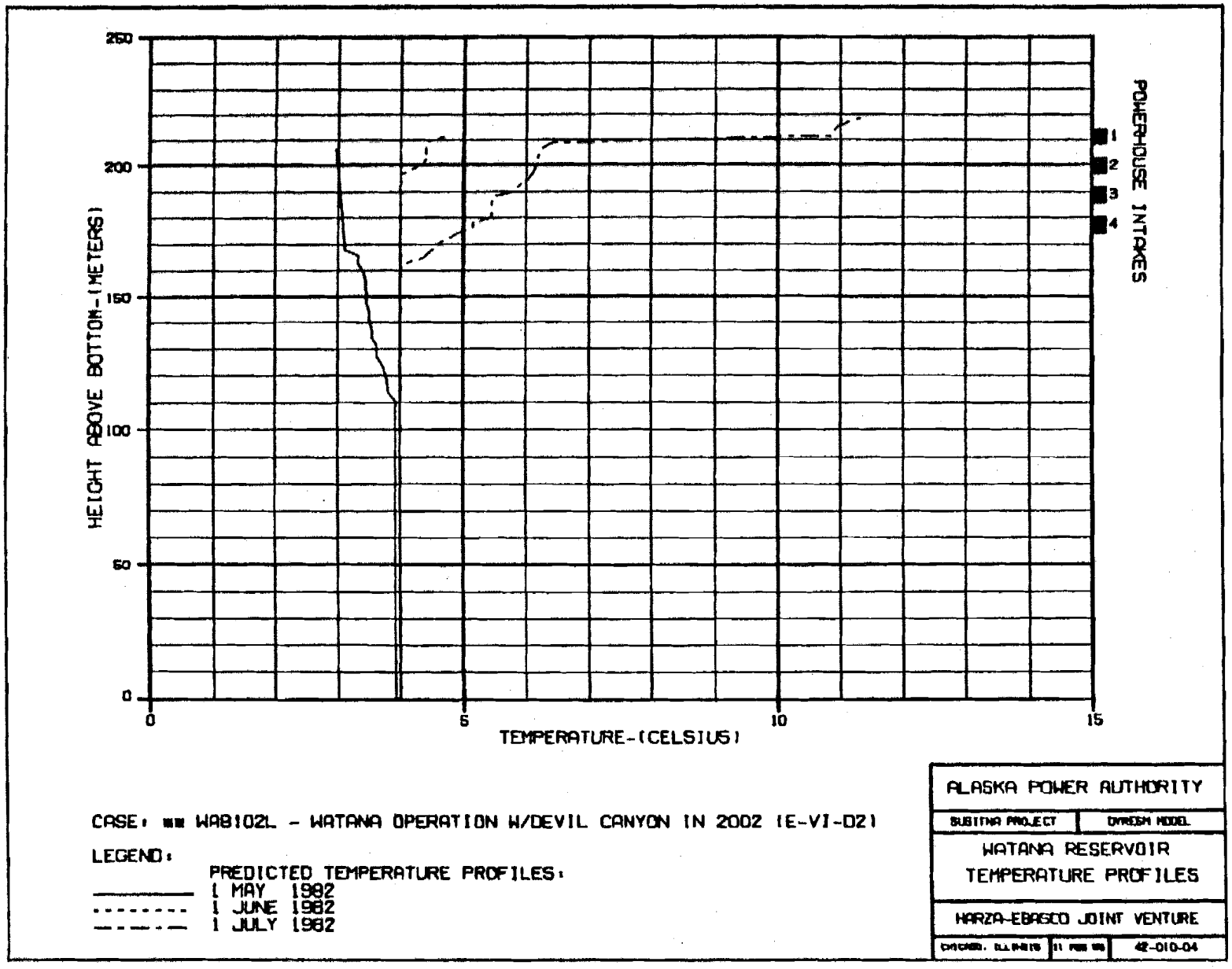
ALASKA POWER AUTHORITY

SUSITNA PROJECT | CYRUS MODEL

WATANA RESERVOIR TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

CHICAGO, ILLINOIS | 11 FEB 88 | 42-010-04



CASE: WAB102L - WATANA OPERATION W/DEVIL CANYON IN 2002 (E-VI-D2)

LEGEND:

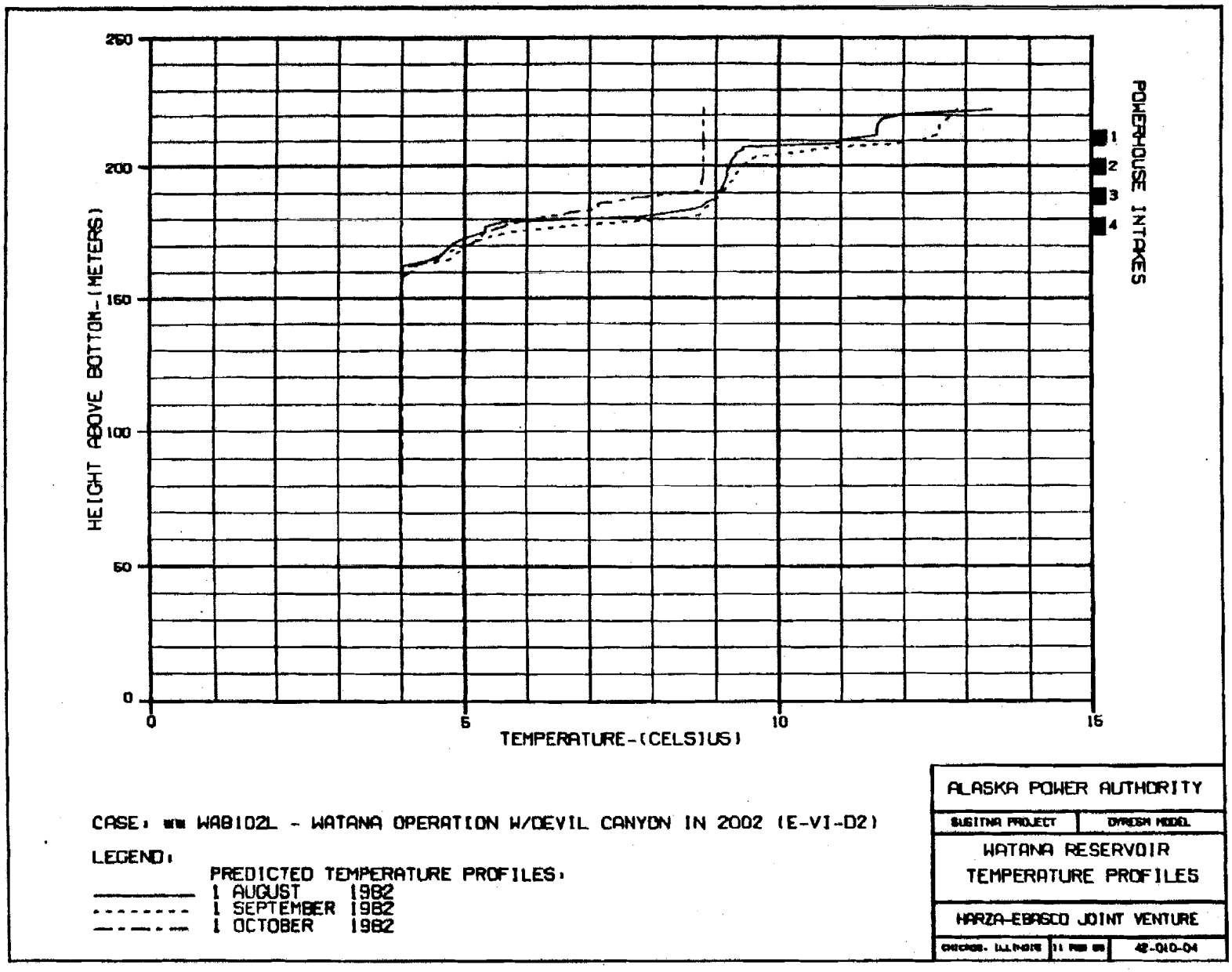
PREDICTED TEMPERATURE PROFILES:

———— 1 MAY 1982

- - - - - - - - 1 JUNE 1982

— — - - — — 1 JULY 1982

ALASKA POWER AUTHORITY
SUSITNA PROJECT | DYRESM MODEL
WATANA RESERVOIR TEMPERATURE PROFILES
HARZA-EBASCO JOINT VENTURE
CHICAGO, ILLINOIS | 11 FEB 86 | 42-010-04



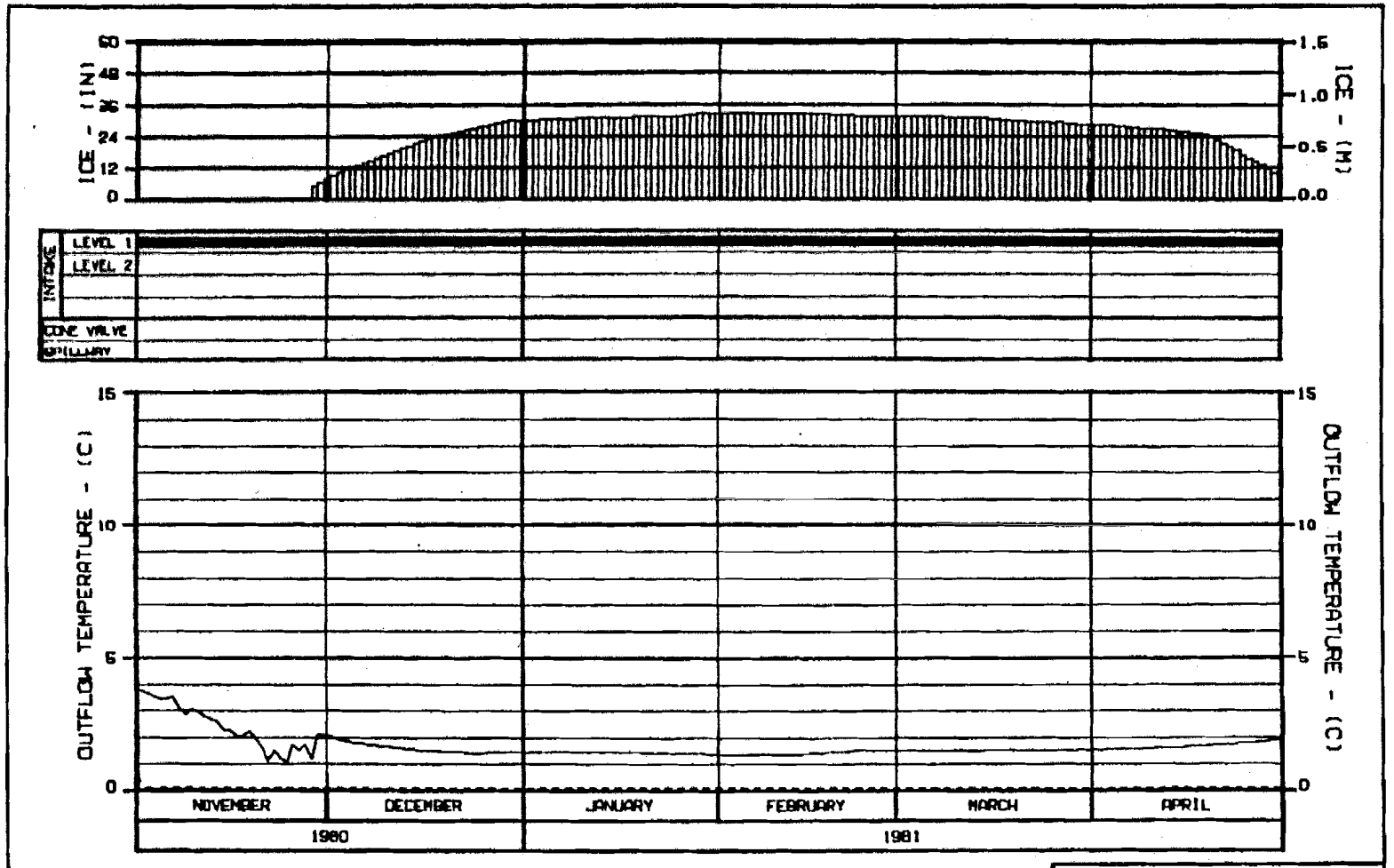
CASE: WAB102L - WATANA OPERATION W/DEVIL CANYON IN 2002 (E-VI-D2)

LEGEND:

PREDICTED TEMPERATURE PROFILES:

———— 1 AUGUST 1982
- - - - - - - - 1 SEPTEMBER 1982
— — — — 1 OCTOBER 1982

ALASKA POWER AUTHORITY	
SUSITNA PROJECT	DYRESM MODEL
WATANA RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
CHICAGO, ILLINOIS	42-010-04



LEGEND: CASE: ## DC8102L - DEVIL CANYON OPERATION W/WATANA IN 2002 (E-VI-02)

———— PREDICTED OUTFLOW TEMPERATURE
- - - - - - - INFLOW TEMPERATURE

NOTES: 1. INTAKE PORT LEVEL 1 AT ELEVATION 1425 FT (434.34 M)
2. INTAKE PORT LEVEL 2 AT ELEVATION 1375 FT (419.10 M)
3. CONE VALVE AT ELEVATION 990 FT (301.75 M)
4. SPILLWAY CREST AT ELEVATION 1404 FT (427.94 M)

ALASKA POWER AUTHORITY

SUSITNA PROJECT	DYRESM MODEL

DEVIL CANYON RESERVOIR
OUTFLOW TEMPERATURE
AND ICE GROWTH

HARZA-EBASCO JOINT VENTURE

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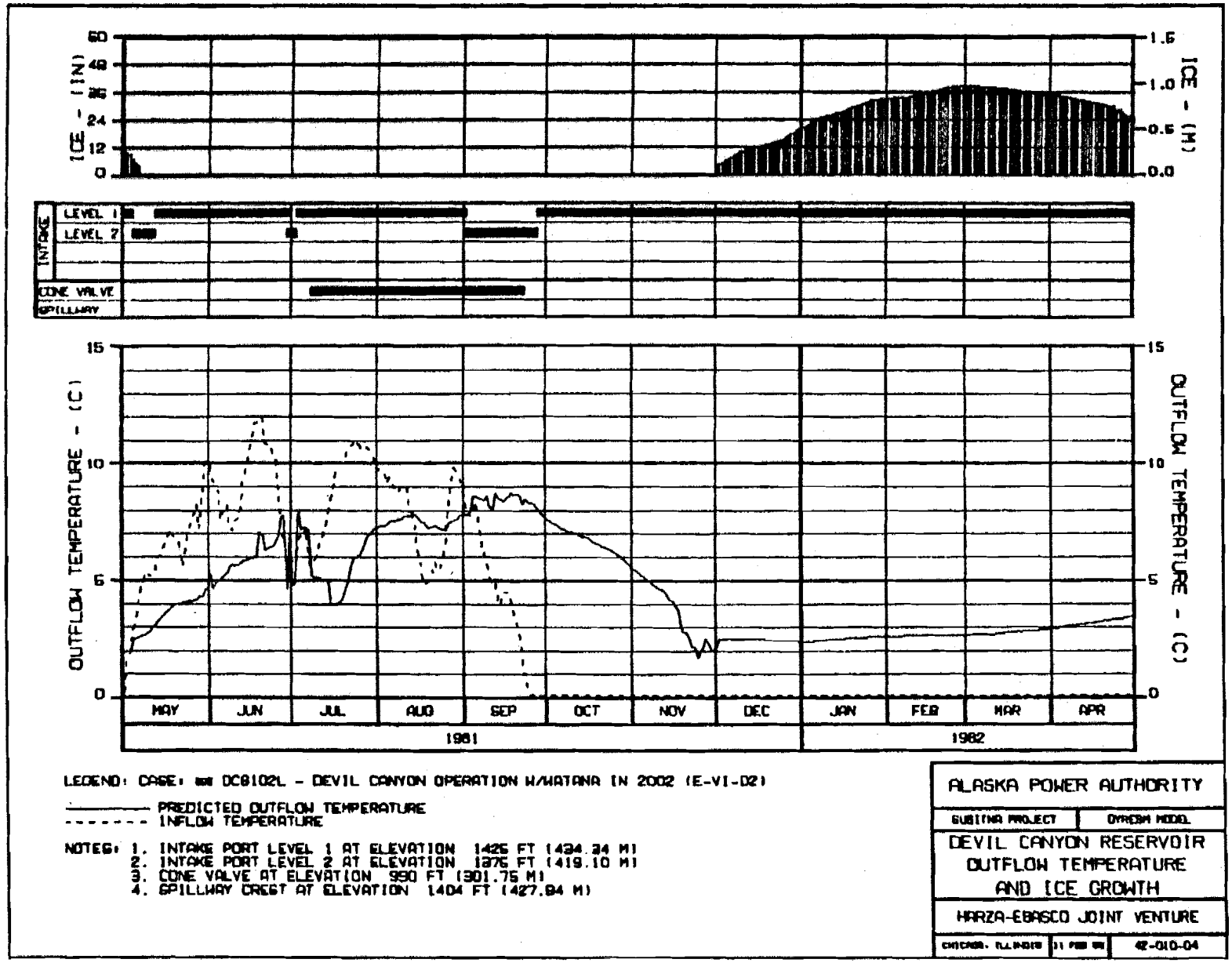
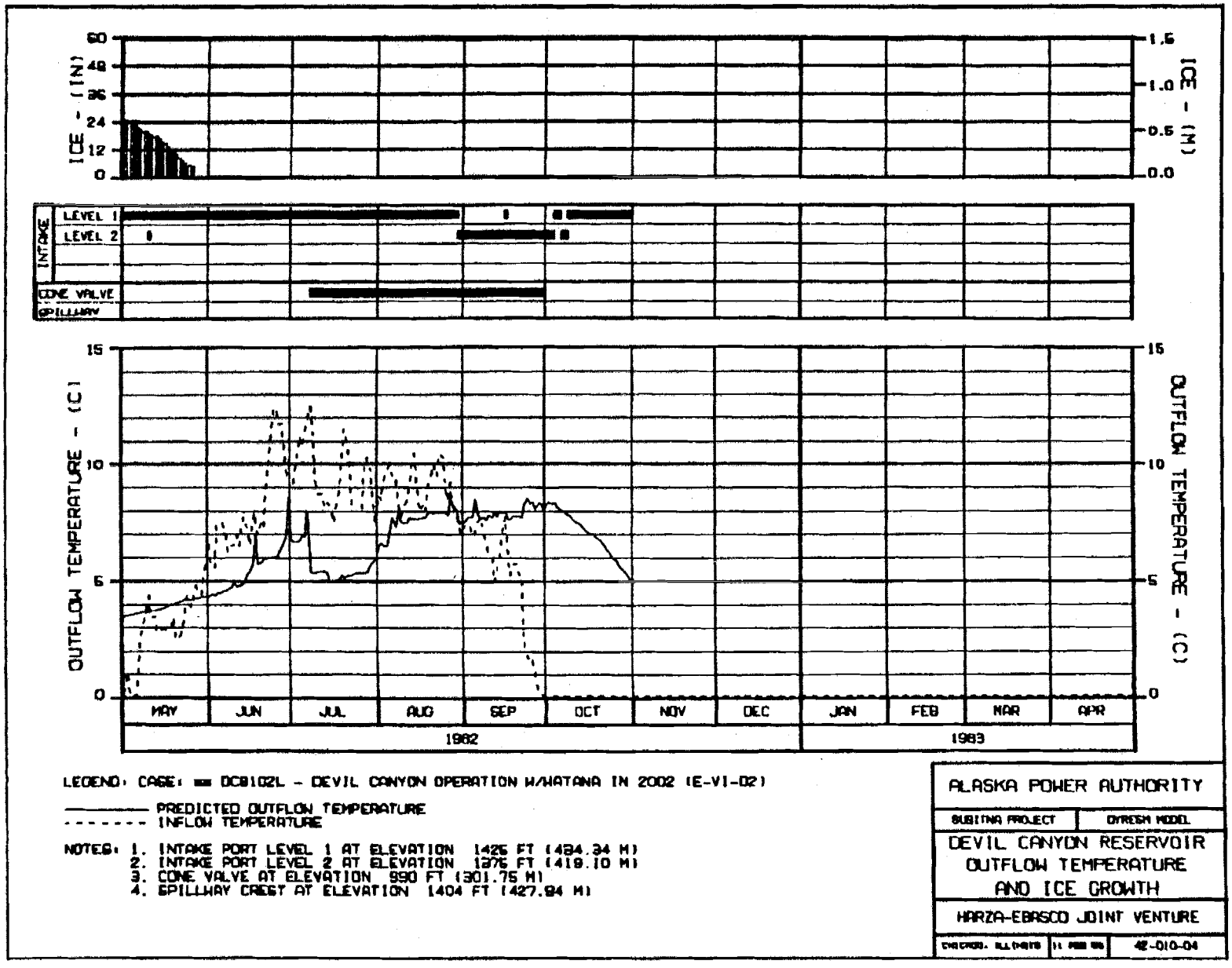


LEGEND: CASE: DC8102L - DEVIL CANYON OPERATION W/WATANA IN 2002 (E-VI-02)

———— PREDICTED OUTFLOW TEMPERATURE
- - - - - - - INFLOW TEMPERATURE

NOTES: 1. INTAKE PORT LEVEL 1 AT ELEVATION 1426 FT (434.24 M)
2. INTAKE PORT LEVEL 2 AT ELEVATION 1376 FT (419.10 M)
3. CONE VALVE AT ELEVATION 990 FT (301.75 M)
4. SPILLWAY CREST AT ELEVATION 1404 FT (427.94 M)

ALASKA POWER AUTHORITY	
SUSITNA PROJECT	DYNESIM MODEL
DEVIL CANYON RESERVOIR OUTFLOW TEMPERATURE AND ICE GROWTH	
HARZA-EBASCO JOINT VENTURE	
CHICAGO, ILLINOIS	42-010-04

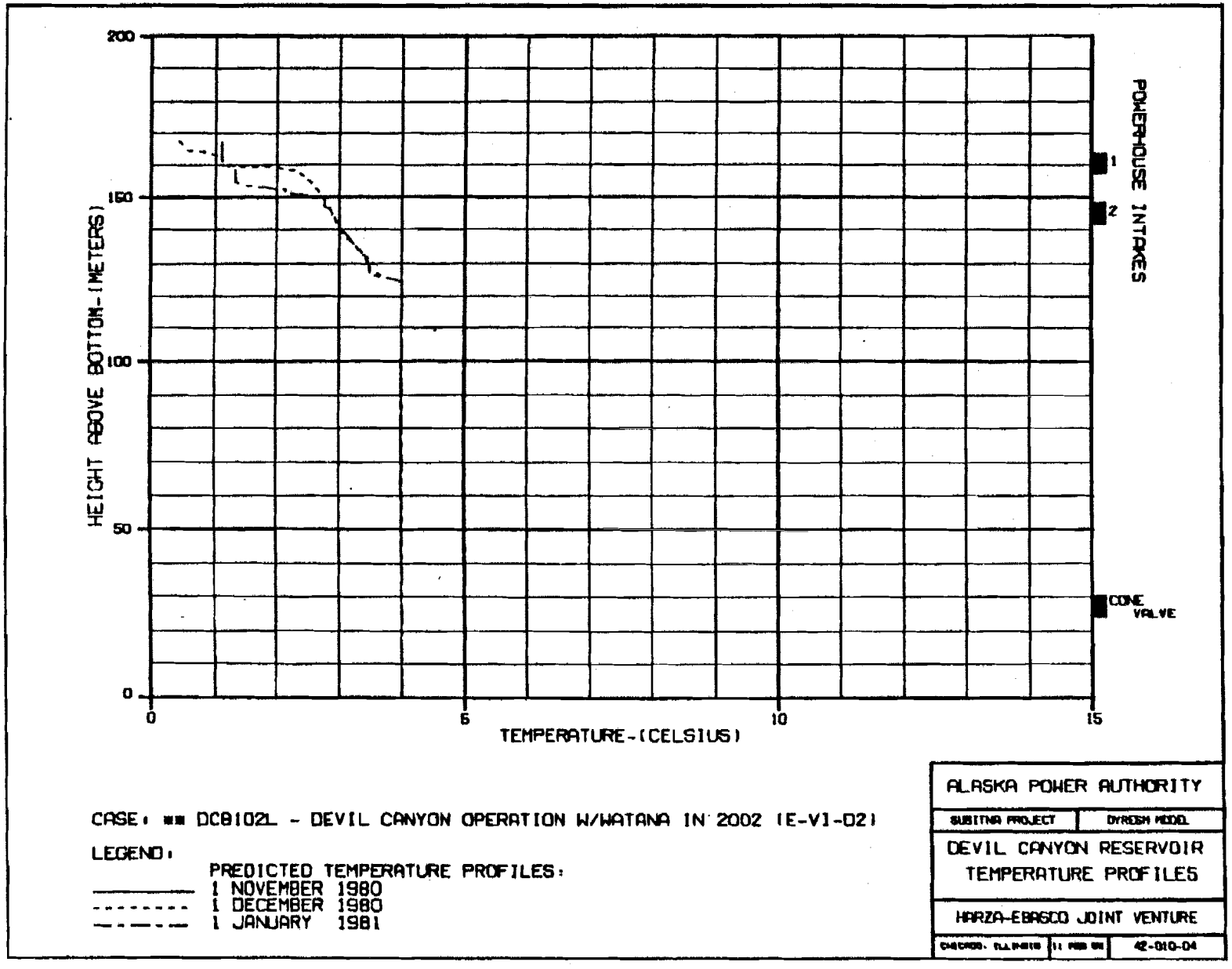


LEGEND: CASE: DCB102L - DEVIL CANYON OPERATION W/WATANA IN 2002 (E-VI-02)

——— PREDICTED OUTFLOW TEMPERATURE
- - - - - - - INFLOW TEMPERATURE

NOTES: 1. INTAKE PORT LEVEL 1 AT ELEVATION 1425 FT (434.34 M)
2. INTAKE PORT LEVEL 2 AT ELEVATION 1376 FT (419.10 M)
3. CONE VALVE AT ELEVATION 990 FT (301.75 M)
4. SPILLWAY CREST AT ELEVATION 1404 FT (427.94 M)

ALASKA POWER AUTHORITY	
SUSITNA PROJECT	DYRESM MODEL
DEVIL CANYON RESERVOIR OUTFLOW TEMPERATURE AND ICE GROWTH	
HARZA-EBASCO JOINT VENTURE	
CHICAGO, ILLINOIS	42-010-04



CASE: DC8102L - DEVIL CANYON OPERATION W/WATANA IN 2002 (E-V1-02)

LEGEND:

PREDICTED TEMPERATURE PROFILES:

——— 1 NOVEMBER 1980

- - - - - - - - 1 DECEMBER 1980

— — — — 1 JANUARY 1981

ALASKA POWER AUTHORITY	
SUSITNA PROJECT	DYRESM MODEL
DEVIL CANYON RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
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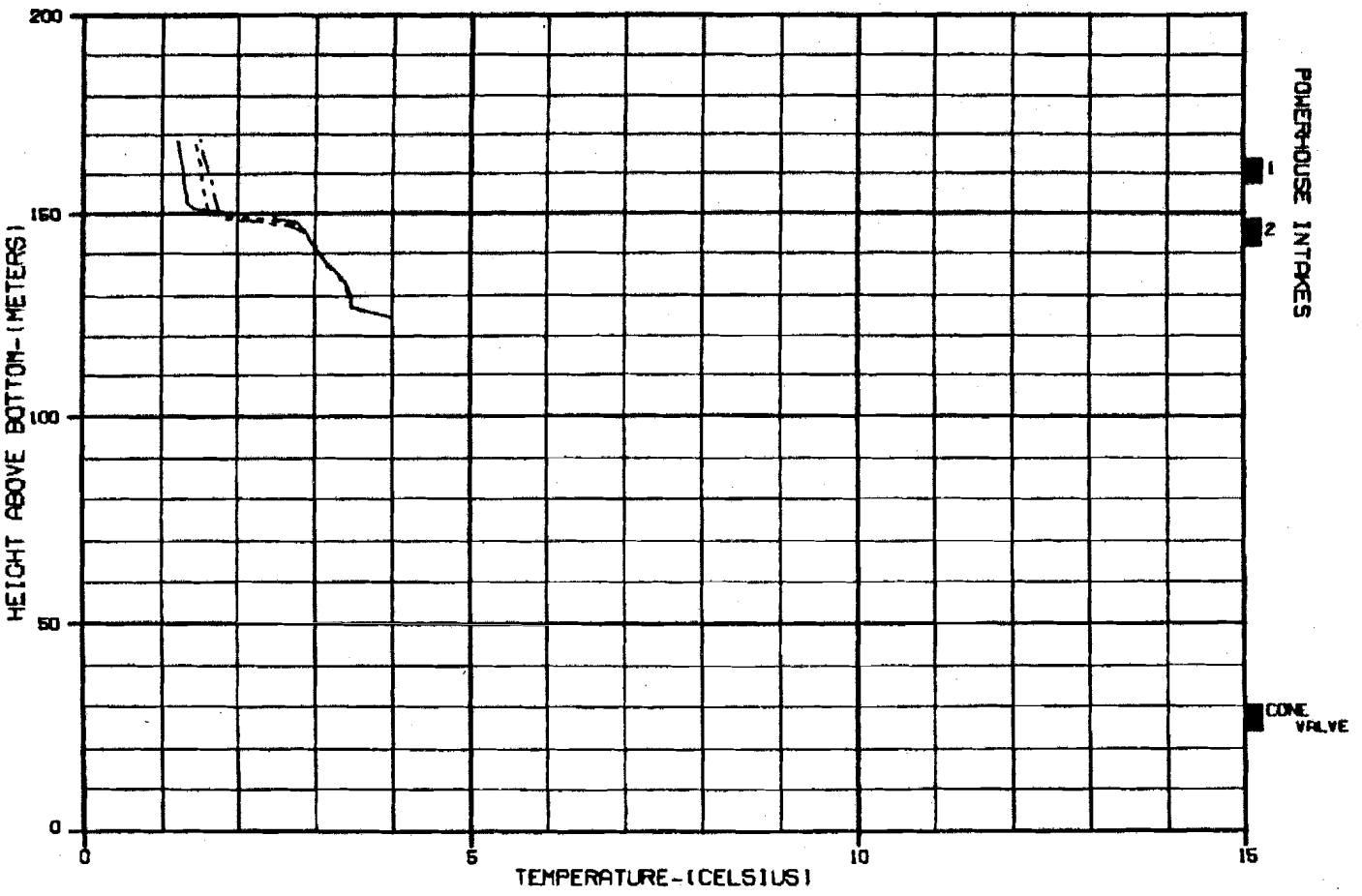


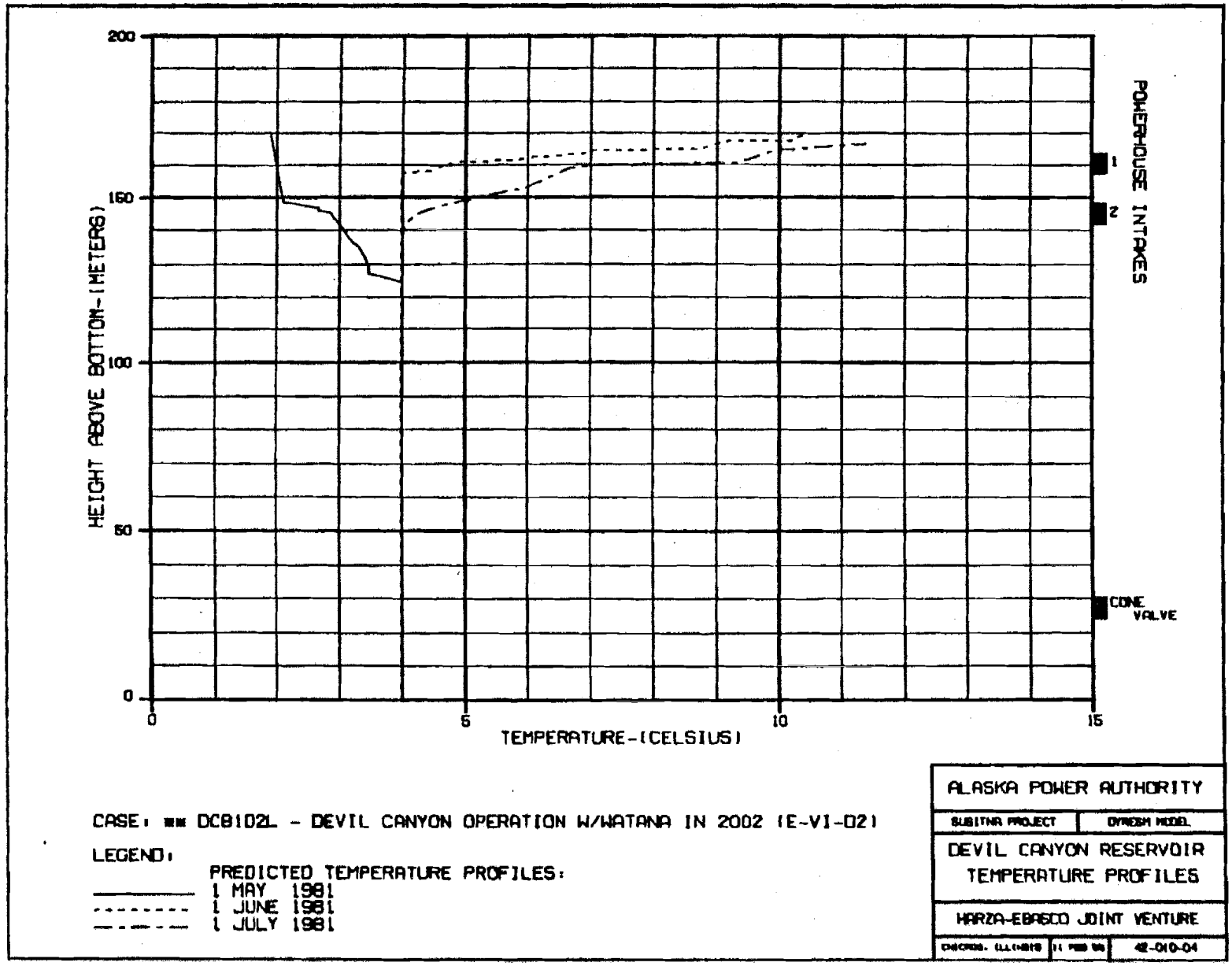
CASE: ww DC8102L - DEVIL CANYON OPERATION W/WATANA IN 2002 (E-V1-02)

LEGEND:

PREDICTED TEMPERATURE PROFILES:

———— 1 FEBRUARY 1981
- - - - - - - - 1 MARCH 1981
—·—·— 1 APRIL 1981

ALASKA POWER AUTHORITY	
SUSITNA PROJECT	DYRESM MODEL
DEVIL CANYON RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
CHICAGO, ILLINOIS	42-010-04



CASE: DCB102L - DEVIL CANYON OPERATION W/WATANA IN 2002 (E-V1-02)

LEGEND:

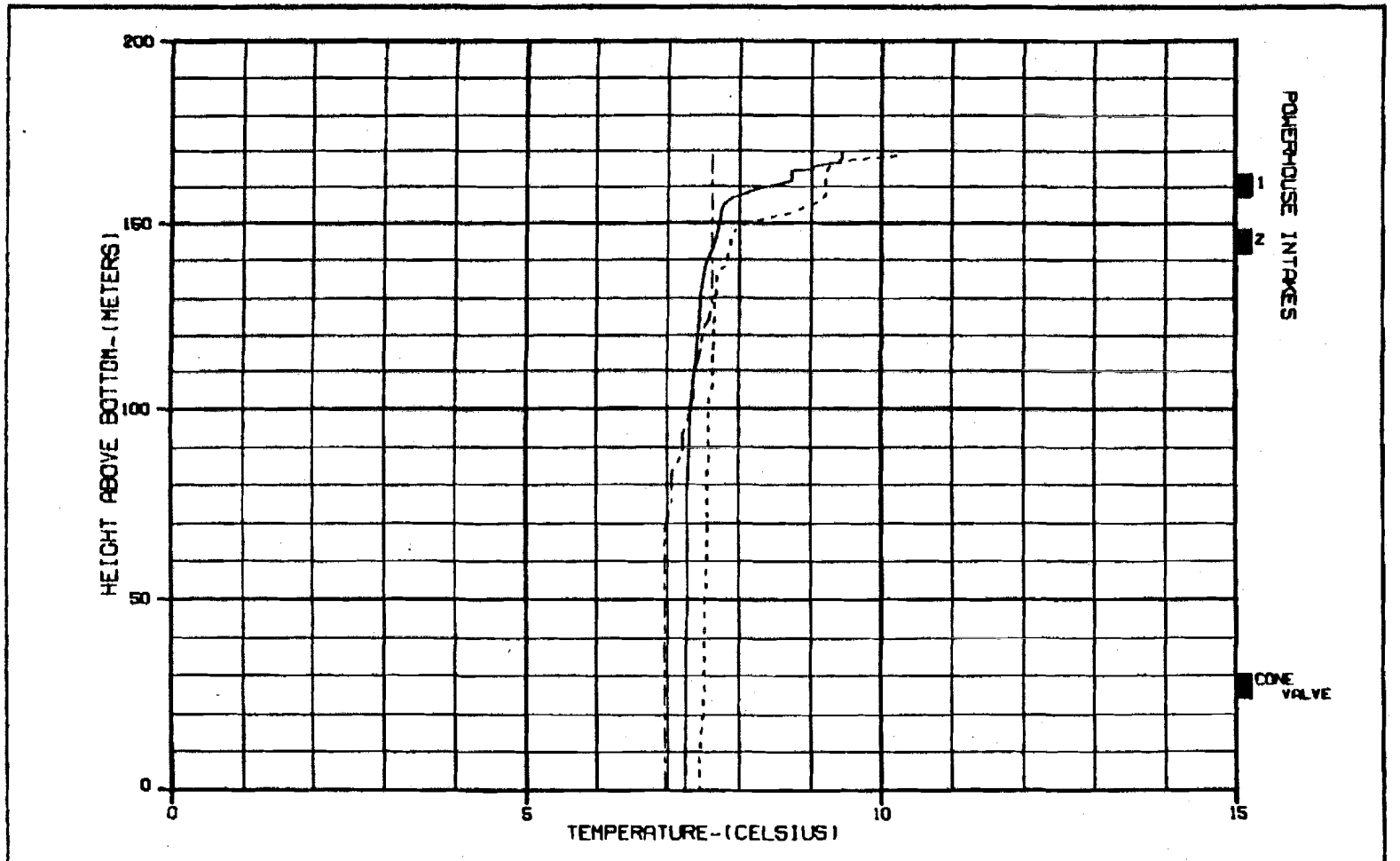
PREDICTED TEMPERATURE PROFILES:

———— 1 MAY 1981

- - - - - - - - 1 JUNE 1981

— — — — 1 JULY 1981

ALASKA POWER AUTHORITY	
SUSITNA PROJECT	DYRESM MODEL
DEVIL CANYON RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
CHICAGO, ILLINOIS	42-010-04



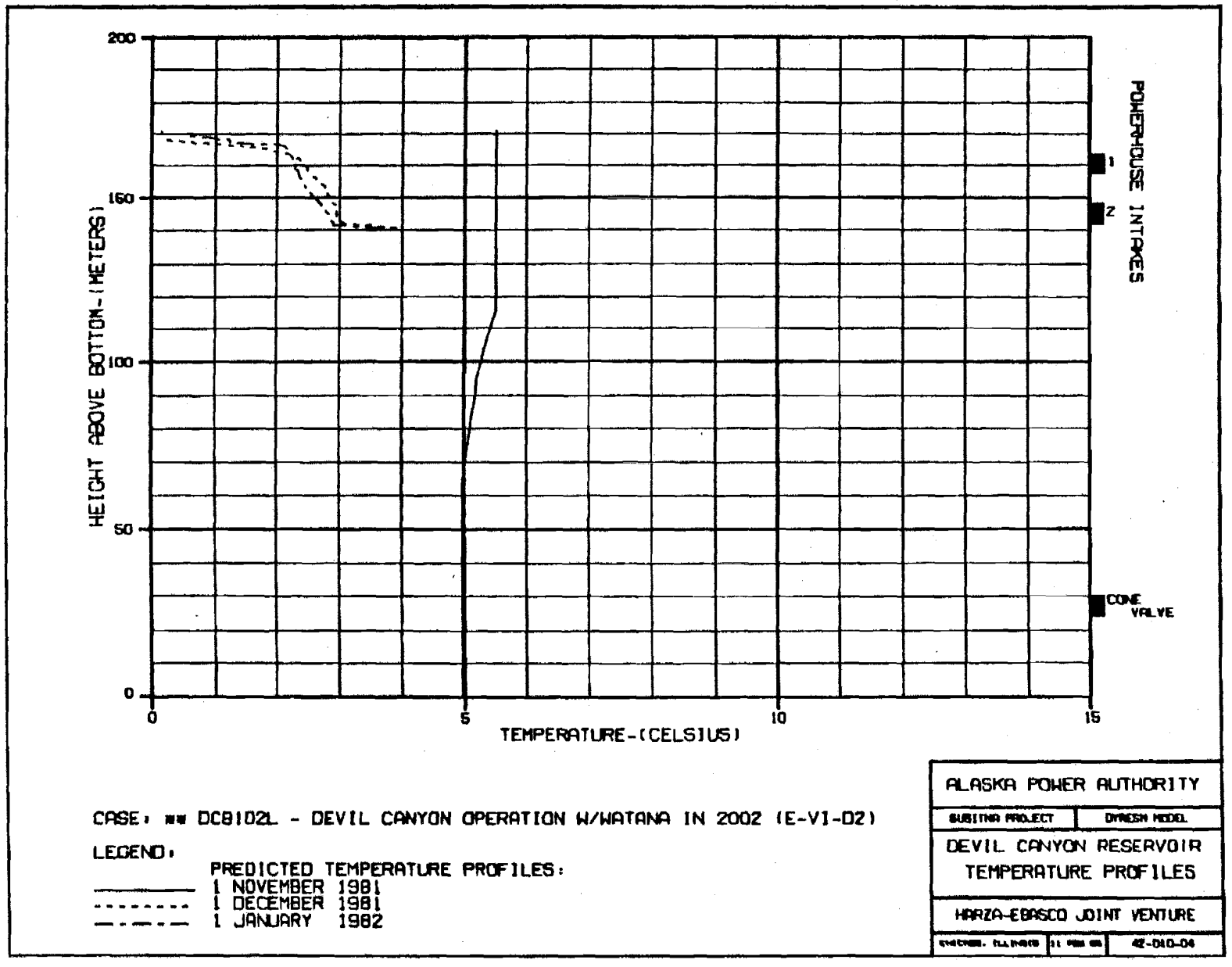
CASE: ** DC8102L - DEVIL CANYON OPERATION W/WATANA IN 2002 (E-V1-02)

LEGEND:

PREDICTED TEMPERATURE PROFILES:

———— 1 AUGUST 1981
- - - - - - - - 1 SEPTEMBER 1981
— - — - — - 1 OCTOBER 1981

ALASKA POWER AUTHORITY	
SUSITNA PROJECT	DYRESM MODEL
DEVIL CANYON RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
CHICAGO, ILLINOIS	42-010-04



CASE: ** DC8102L - DEVIL CANYON OPERATION W/WATANA IN 2002 (E-V1-02)

LEGEND:

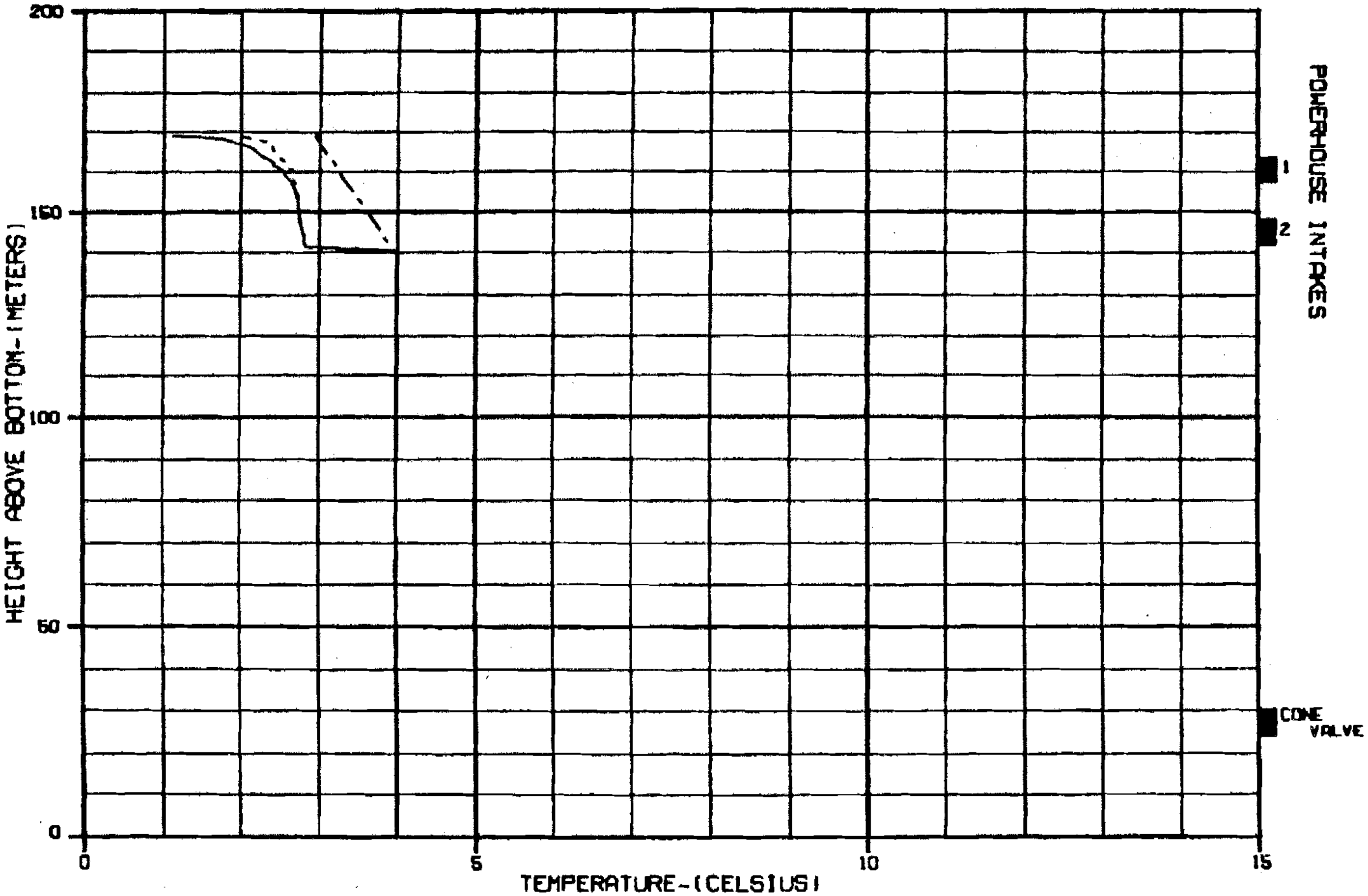
PREDICTED TEMPERATURE PROFILES:

———— 1 NOVEMBER 1981

- - - - - - - - 1 DECEMBER 1981

—·—·— 1 JANUARY 1982

ALASKA POWER AUTHORITY	
SUSITNA PROJECT	DYRESM MODEL
DEVIL CANYON RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
[illegible]	11 FEB 85	42-010-04



CASE: ** DC8102L - DEVIL CANYON OPERATION W/WATANA IN 2002 (E-VI-02)

LEGEND:

PREDICTED TEMPERATURE PROFILES:

————	1 FEBRUARY	1982
--------	1 MARCH	1982
—-—-—	1 APRIL	1982

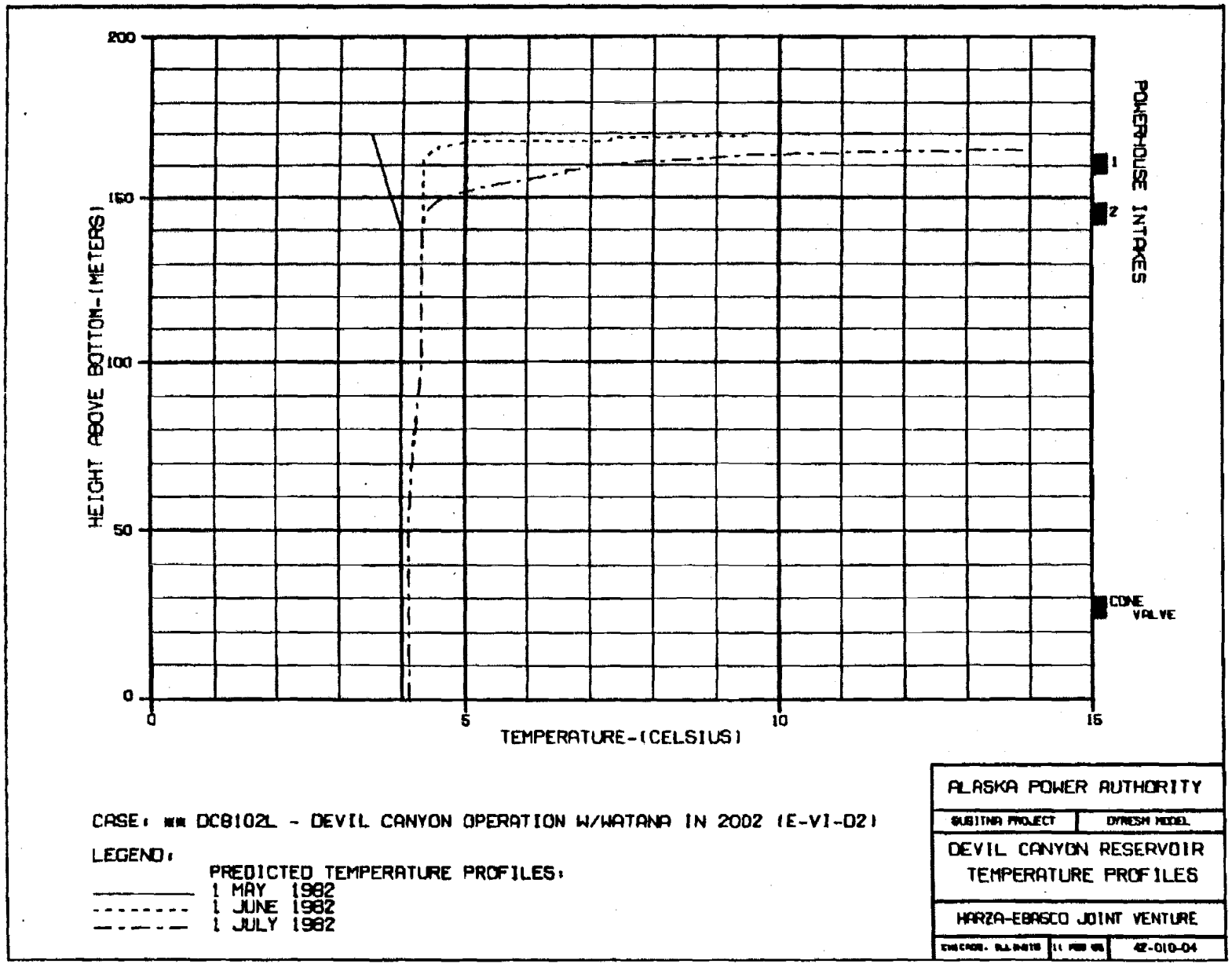
ALASKA POWER AUTHORITY

SUSITNA PROJECT | DYRESM MODEL

DEVIL CANYON RESERVOIR TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

CHICAGO, ILLINOIS | [illegible] | 42-010-04



CASE: DC8102L - DEVIL CANYON OPERATION W/WATANA IN 2002 (E-VI-02)

LEGEND:

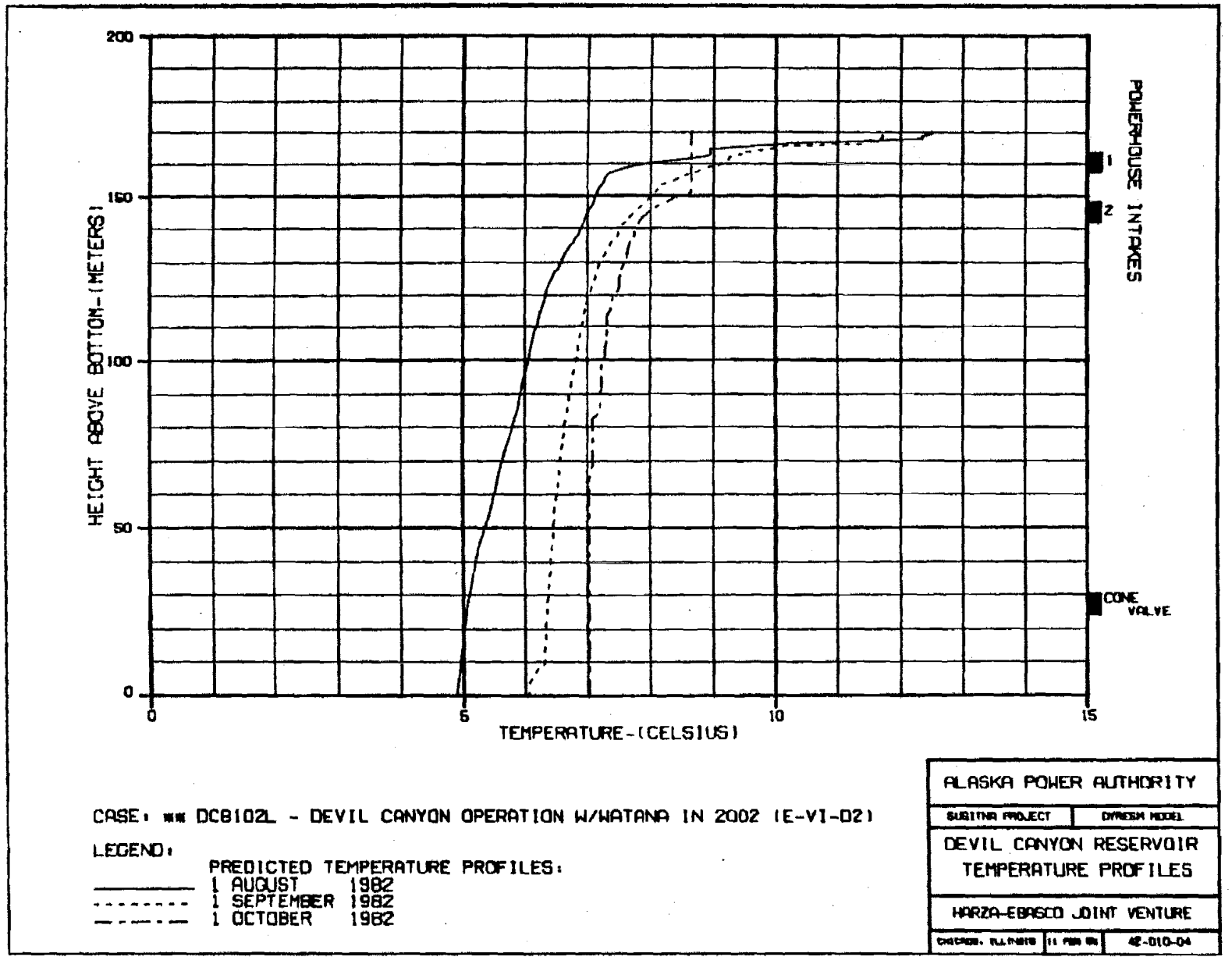
PREDICTED TEMPERATURE PROFILES:

———— 1 MAY 1982

- - - - - - - - 1 JUNE 1982

— — — — 1 JULY 1982

ALASKA POWER AUTHORITY	
SUSITNA PROJECT	DYRESM MODEL
DEVIL CANYON RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
CHICAGO, ILLINOIS	11 FEB 88	42-010-04



CASE: ** DC8102L - DEVIL CANYON OPERATION W/WATANA IN 2002 (E-VI-02)

LEGEND:

PREDICTED TEMPERATURE PROFILES:

———— 1 AUGUST 1982
- - - - - - - - 1 SEPTEMBER 1982
— - — - — 1 OCTOBER 1982

ALASKA POWER AUTHORITY	
SUSITNA PROJECT	DYRESM MODEL
DEVIL CANYON RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
CHICAGO, ILLINOIS	11 FEB 83	42-010-04

Exhibit H-2

CASE C RESERVOIR TEMPERATURE SIMULATIONS

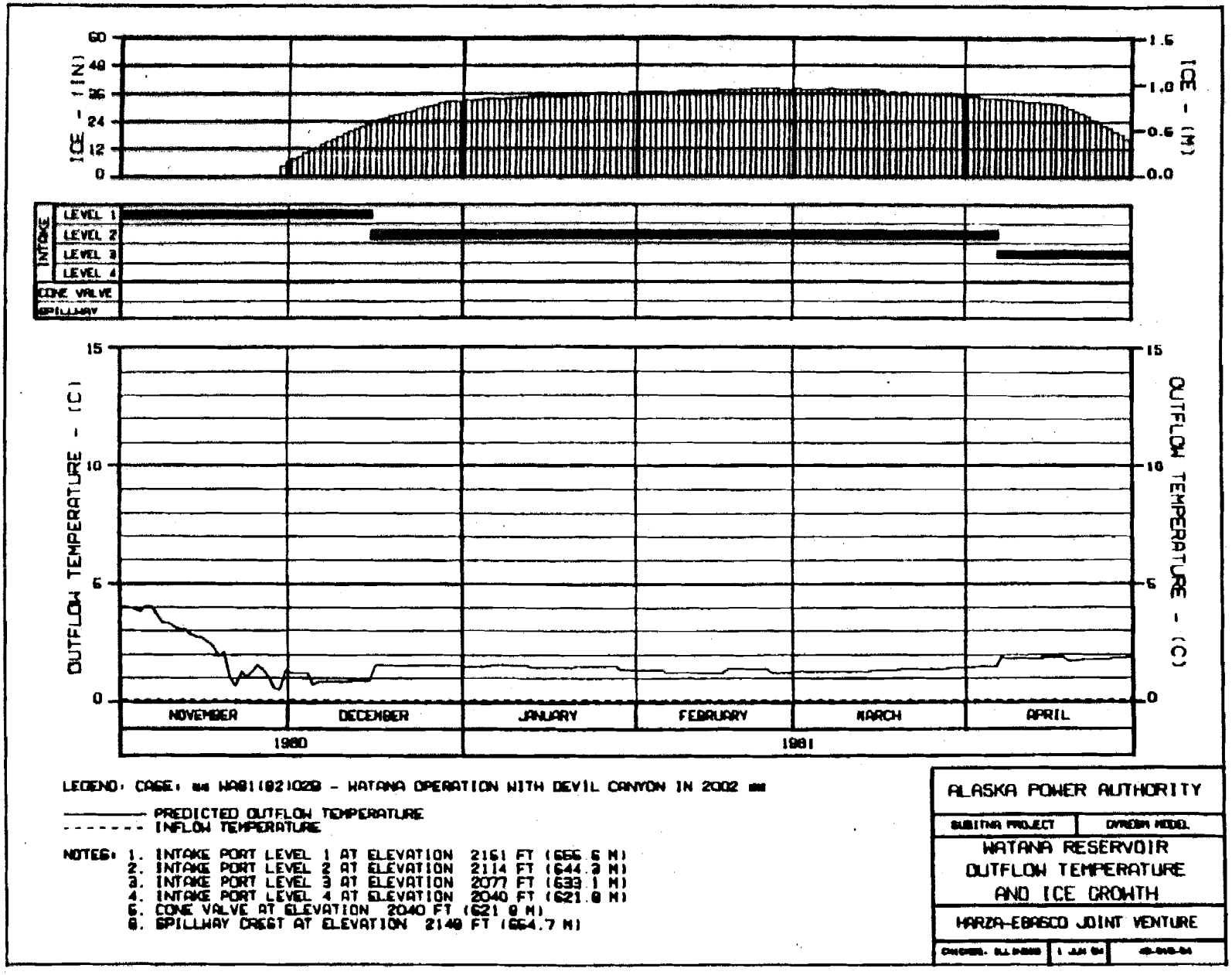
FOR

PROJECTED ENERGY DEMANDS - YEAR 2002

- Outflow Temperature and Ice Growth Curves
- Temperature Profiles

Note: 1. Simulations are based on hydrologic and meteorologic data from the period November 1980 to September 1982.

2. Corresponds to Exhibits AC, AD, AM and AN, Alaska Power Authority 1984a.



LEGEND: CASE: ** WA81(02)029 - WATANA OPERATION WITH DEVIL CANYON IN 2002 **

——— PREDICTED OUTFLOW TEMPERATURE
- - - - - - - INFLOW TEMPERATURE

NOTES:
1. INTAKE PORT LEVEL 1 AT ELEVATION 2161 FT (665.6 M)
2. INTAKE PORT LEVEL 2 AT ELEVATION 2114 FT (644.3 M)
3. INTAKE PORT LEVEL 3 AT ELEVATION 2077 FT (633.1 M)
4. INTAKE PORT LEVEL 4 AT ELEVATION 2040 FT (621.8 M)
5. CONE VALVE AT ELEVATION 2040 FT (621.8 M)
6. SPILLWAY CREST AT ELEVATION 2149 FT (654.7 M)

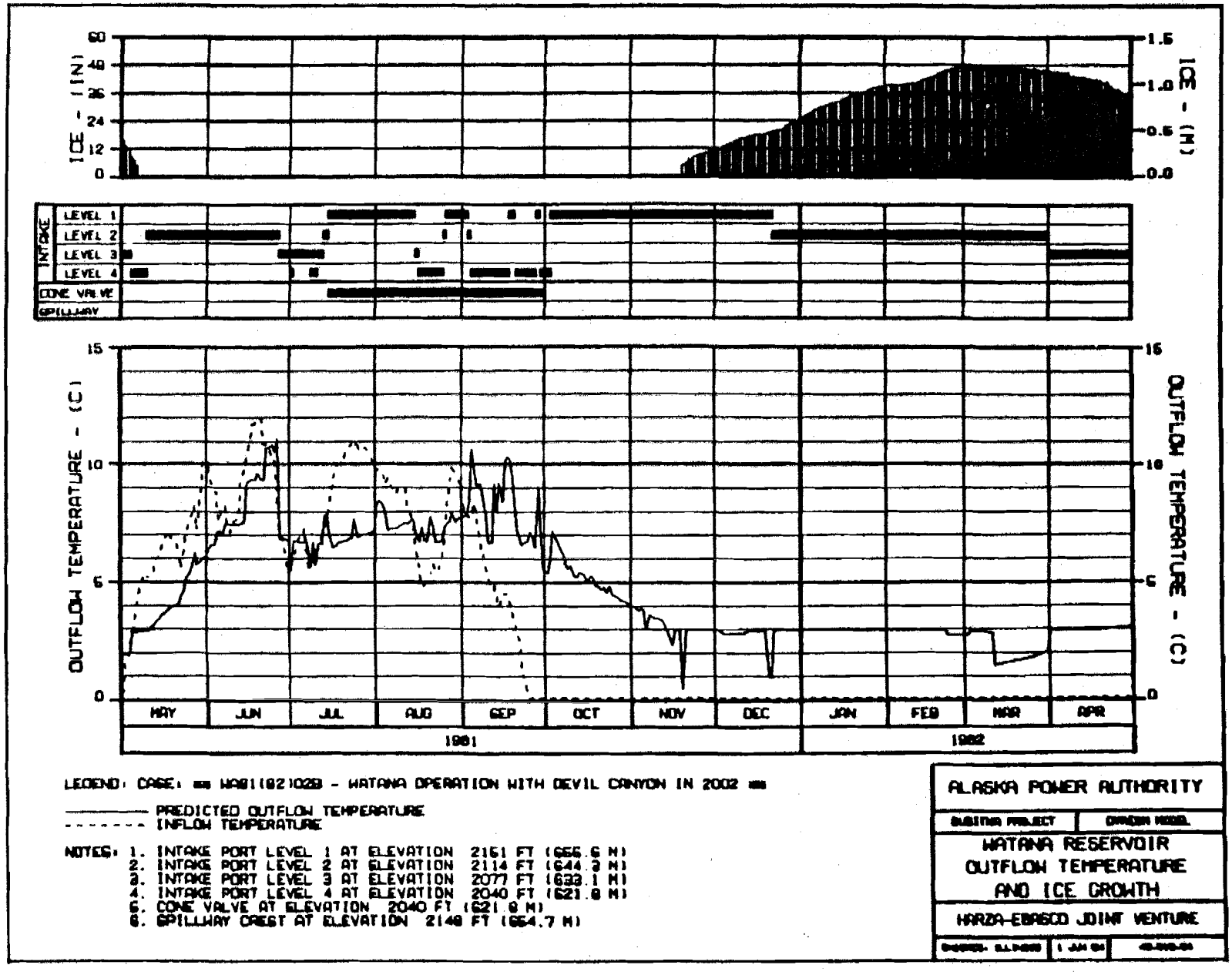
ALASKA POWER AUTHORITY

SUSITNA PROJECT | DYNSIM MODEL

WATANA RESERVOIR
OUTFLOW TEMPERATURE
AND ICE GROWTH

HARZA-EBASCO JOINT VENTURE

CHECKED: [illegible] | 1 JAN 84 | [illegible]



LEGEND: CASE: WA81102102B - WATANA OPERATION WITH DEVIL CANYON IN 2002

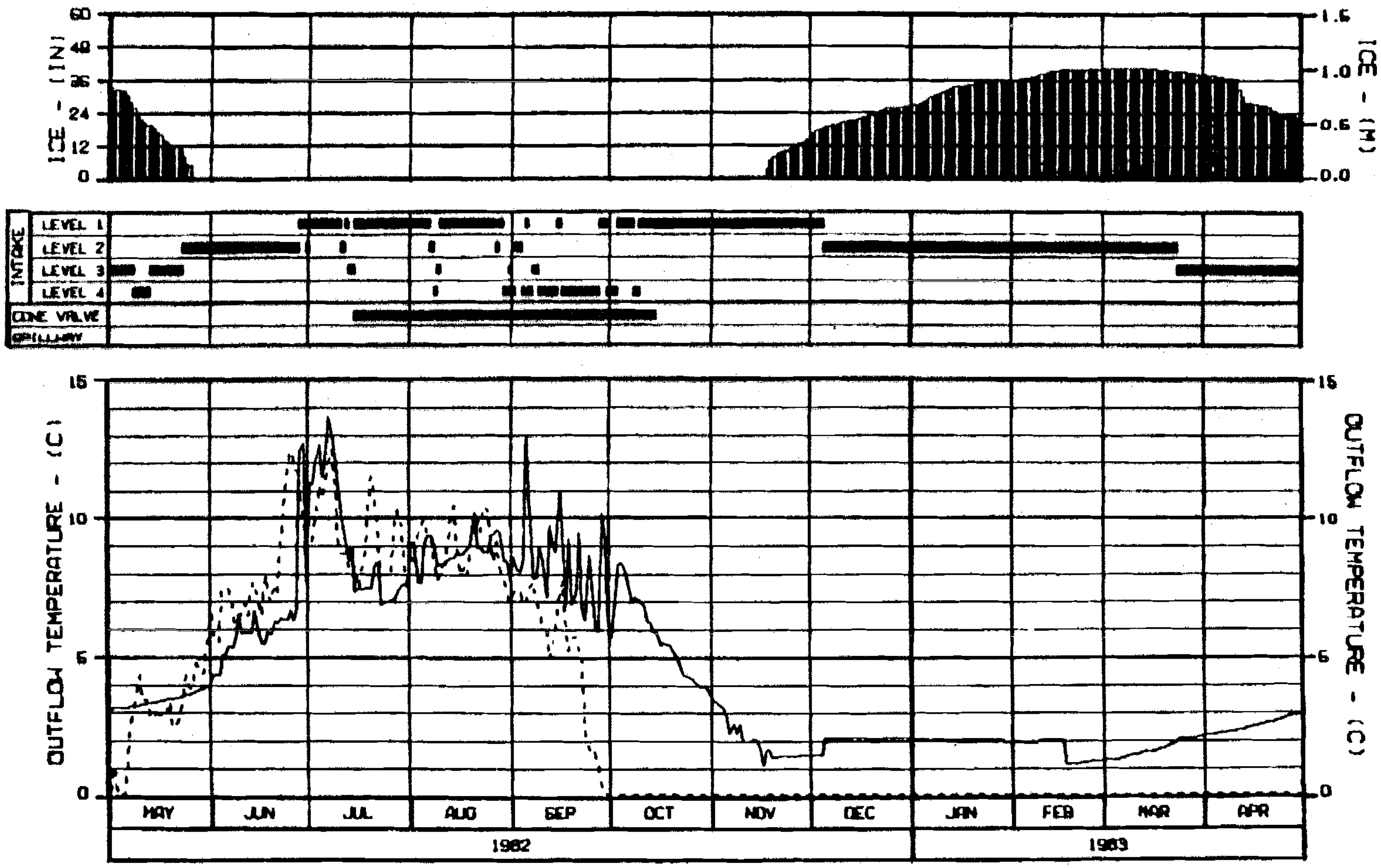
——— PREDICTED OUTFLOW TEMPERATURE
- - - - - - - INFLOW TEMPERATURE

NOTES:
1. INTAKE PORT LEVEL 1 AT ELEVATION 2161 FT (656.6 M)
2. INTAKE PORT LEVEL 2 AT ELEVATION 2114 FT (644.3 M)
3. INTAKE PORT LEVEL 3 AT ELEVATION 2077 FT (633.1 M)
4. INTAKE PORT LEVEL 4 AT ELEVATION 2040 FT (621.8 M)
5. CONE VALVE AT ELEVATION 2040 FT (621.8 M)
6. SPILLWAY CREST AT ELEVATION 2148 FT (654.7 M)

ALASKA POWER AUTHORITY

WATANA RESERVOIR
OUTFLOW TEMPERATURE
AND ICE GROWTH

HARZA-EBASCO JOINT VENTURE



LEGEND: CASE: ** WA81(82)028 - WATANA OPERATION WITH DEVIL CANYON IN 2002 **

———— PREDICTED OUTFLOW TEMPERATURE
- - - - - - - INFLOW TEMPERATURE

NOTES:
1. INTAKE PORT LEVEL 1 AT ELEVATION 2151 FT (655.6 M)
2. INTAKE PORT LEVEL 2 AT ELEVATION 2114 FT (644.3 M)
3. INTAKE PORT LEVEL 3 AT ELEVATION 2077 FT (633.1 M)
4. INTAKE PORT LEVEL 4 AT ELEVATION 2040 FT (621.8 M)
5. CONE VALVE AT ELEVATION 2040 FT (621.8 M)
6. SPILLWAY CREST AT ELEVATION 2148 FT (654.7 M)

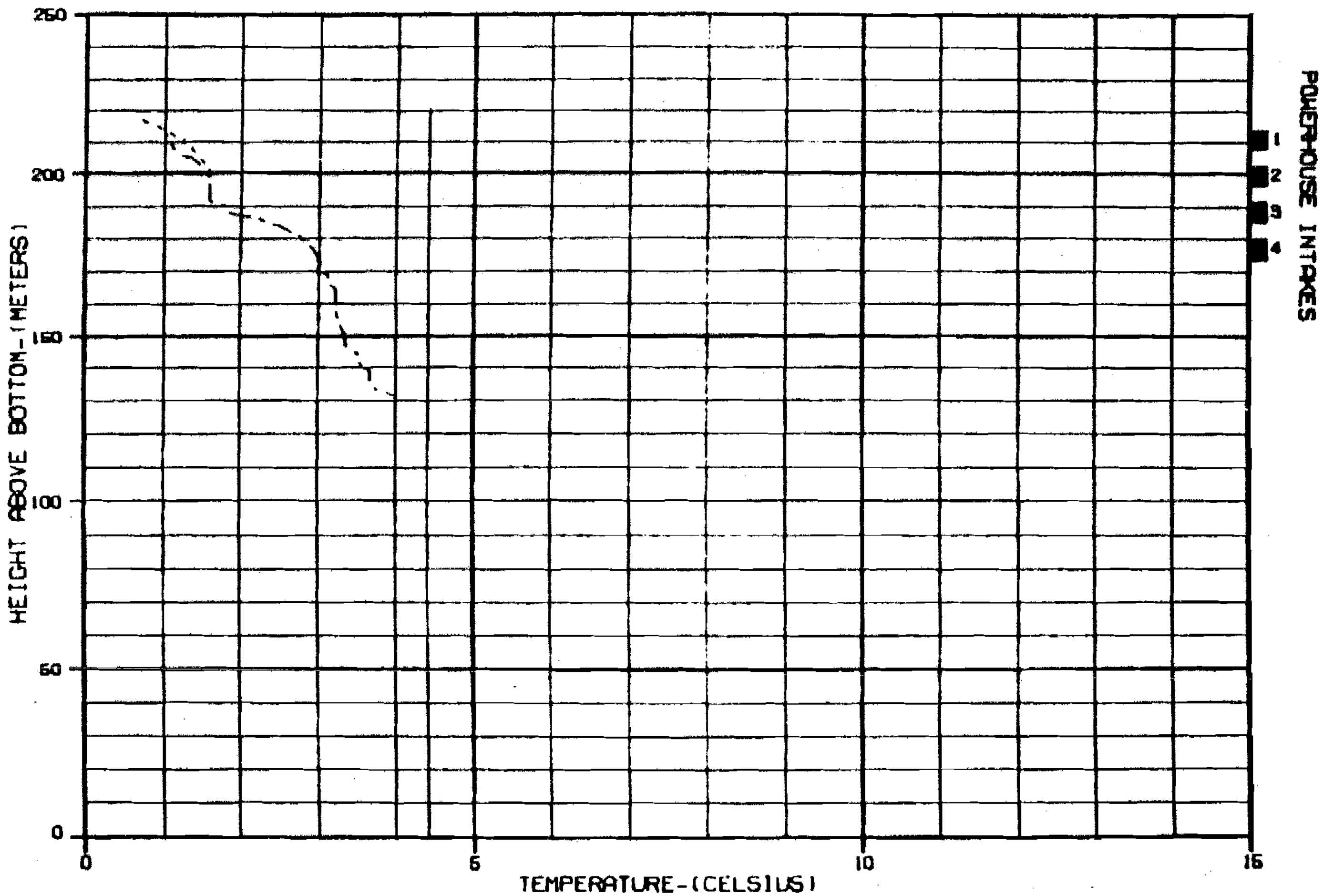
ALASKA POWER AUTHORITY

SUSITNA PROJECT | DYRESM MODEL

WATANA RESERVOIR
OUTFLOW TEMPERATURE
AND ICE GROWTH

HARZA-EBASCO JOINT VENTURE

CHICAGO, ILLINOIS | 1 JAN 84 | [illegible]



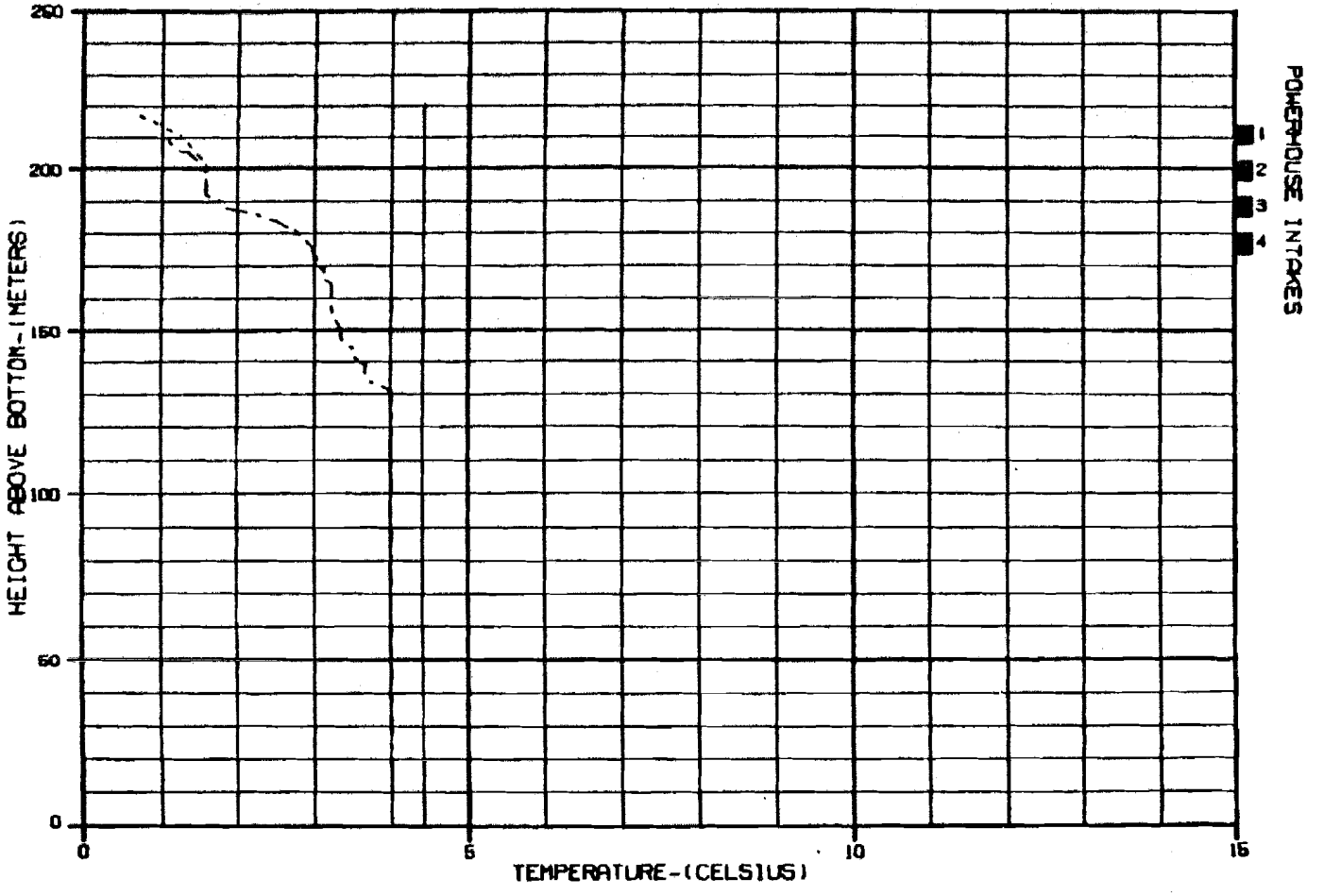
CASE: ** WA811B2102B - WATANA OPERATION WITH DEVIL CANYON IN 2002 **

LEGEND:

PREDICTED TEMPERATURE PROFILES

- ———— 1 NOVEMBER 1980
- - - - - - 1 DECEMBER 1980
- —-—-— 1 JANUARY 1981

ALASKA POWER AUTHORITY	
SUSITNA PROJECT	
WATANA RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	



CASE: ■■ WA81(82)02B - WATANA OPERATION WITH DEVIL CANYON IN 2002 ■■

LEGEND:

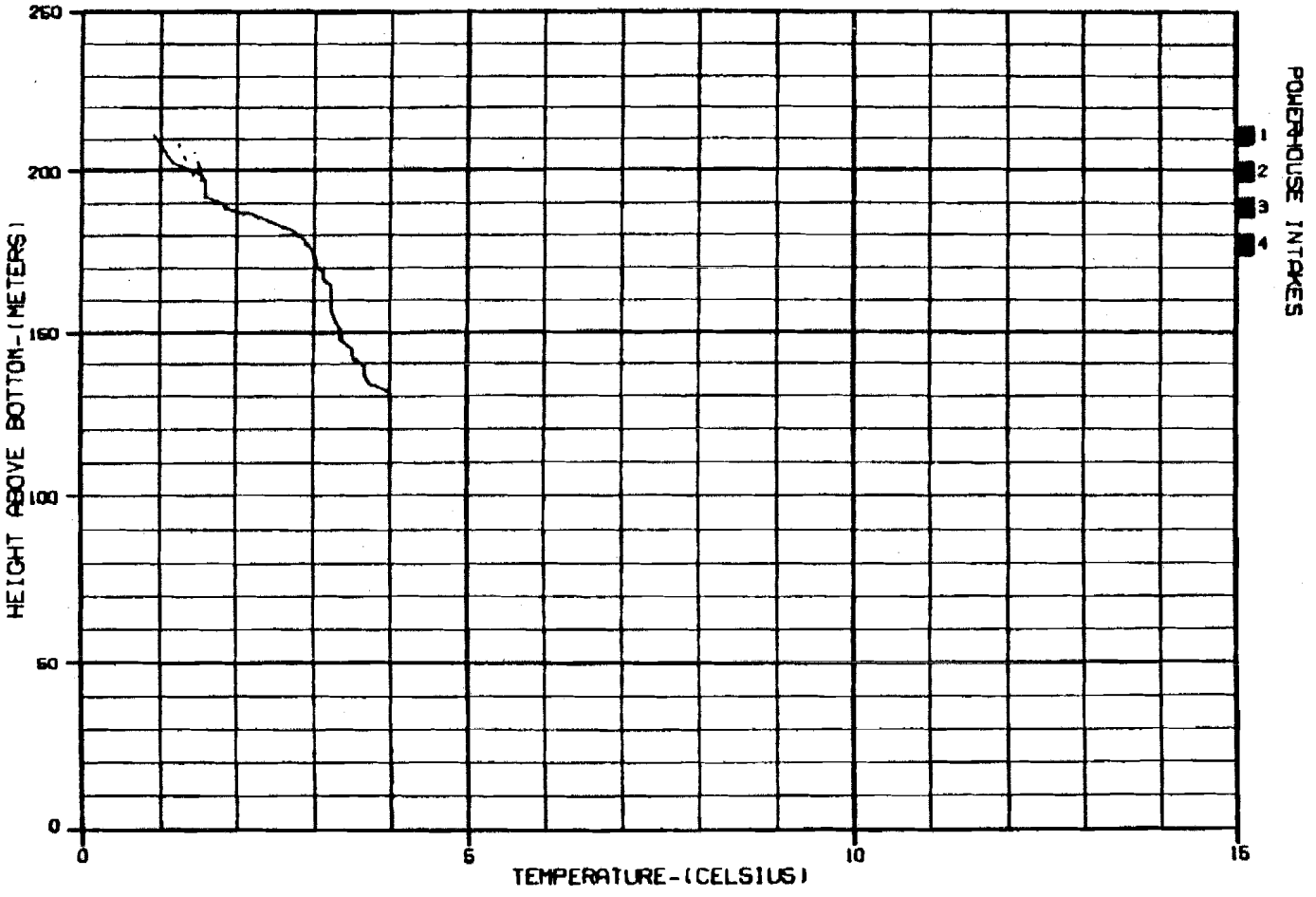
PREDICTED TEMPERATURE PROFILES:

———— 1 NOVEMBER 1980

- - - - - - - - 1 DECEMBER 1980

—·—·— 1 JANUARY 1981

ALASKA POWER AUTHORITY	
SUSITNA PROJECT	DYRESM MODEL
WATANA RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
[illegible]	1 JAN 84
	42-010-04



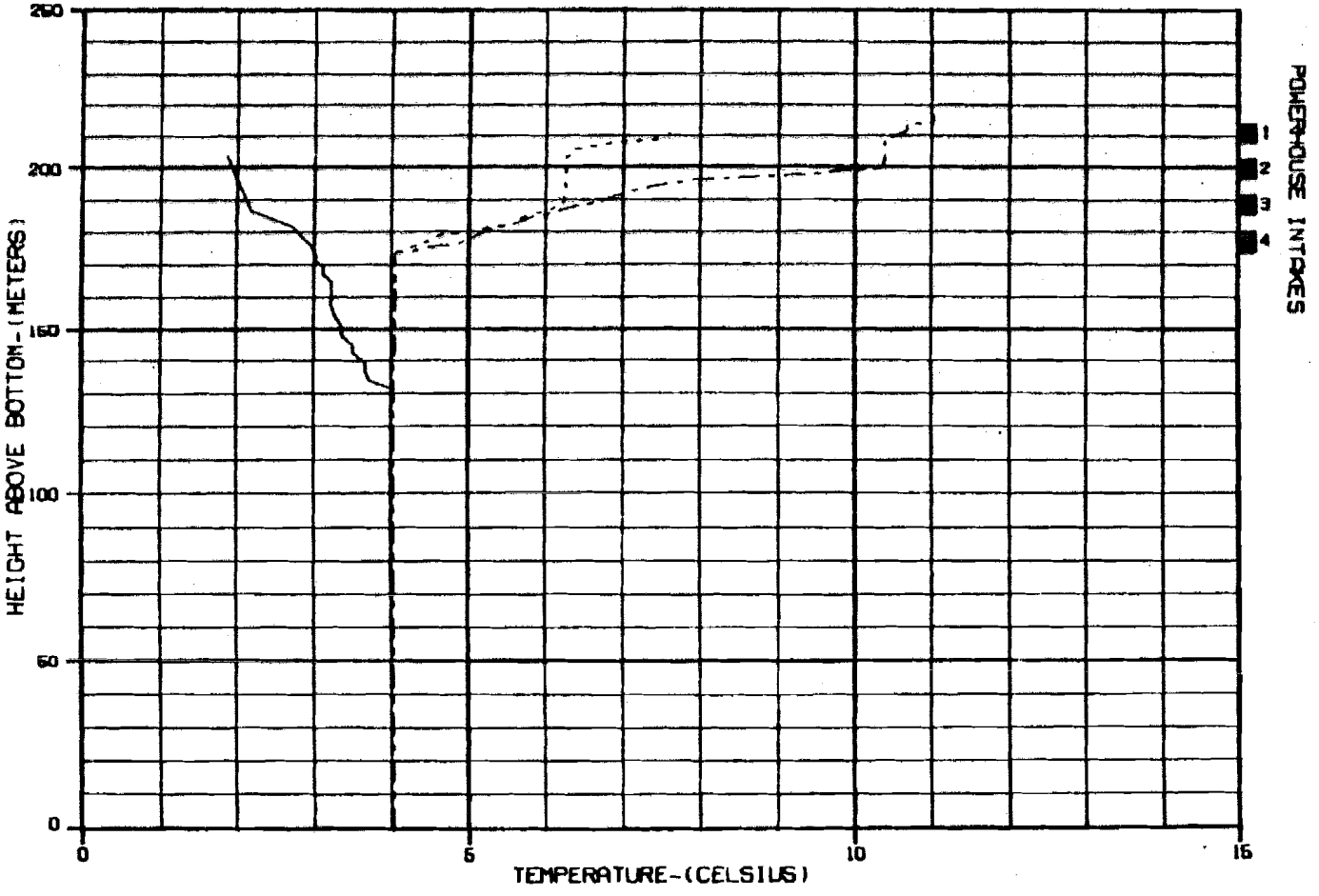
CASE: WA811821028 - WATANA OPERATION WITH DEVIL CANYON IN 2002

LEGEND:

PREDICTED TEMPERATURE PROFILES:

———— 1 FEBRUARY 1981
- - - - - - - - 1 MARCH 1981
— — — — 1 APRIL 1981

ALASKA POWER AUTHORITY	
SUSITNA PROJECT	DIVISION MODEL
WATANA RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
DRAWING NO.	1 JUN 84	4E-010-04



CASE: WA811821028 - WATANA OPERATION WITH DEVIL CANYON IN 2002.

LEGEND:

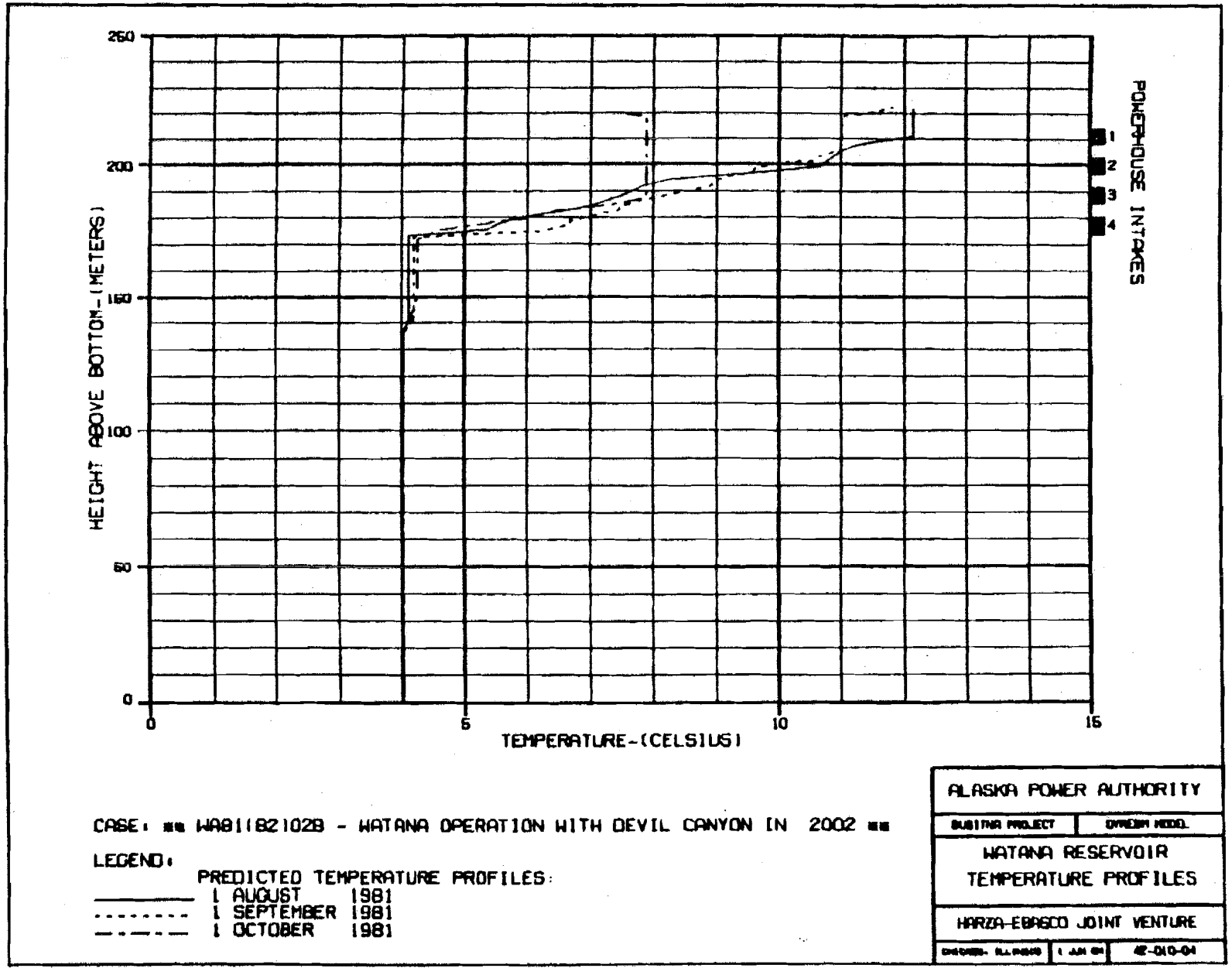
PREDICTED TEMPERATURE PROFILES:

———— 1 MAY 1981

- - - - - - - - 1 JUNE 1981

— — - - — — 1 JULY 1981

ALASKA POWER AUTHORITY	
SUSITNA PROJECT	CHEQUA MODEL
WATANA RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
DRAWING NO. [illegible]	1 JAN 84	42-010-04



CASE: WA811821028 - WATANA OPERATION WITH DEVIL CANYON IN 2002

LEGEND:

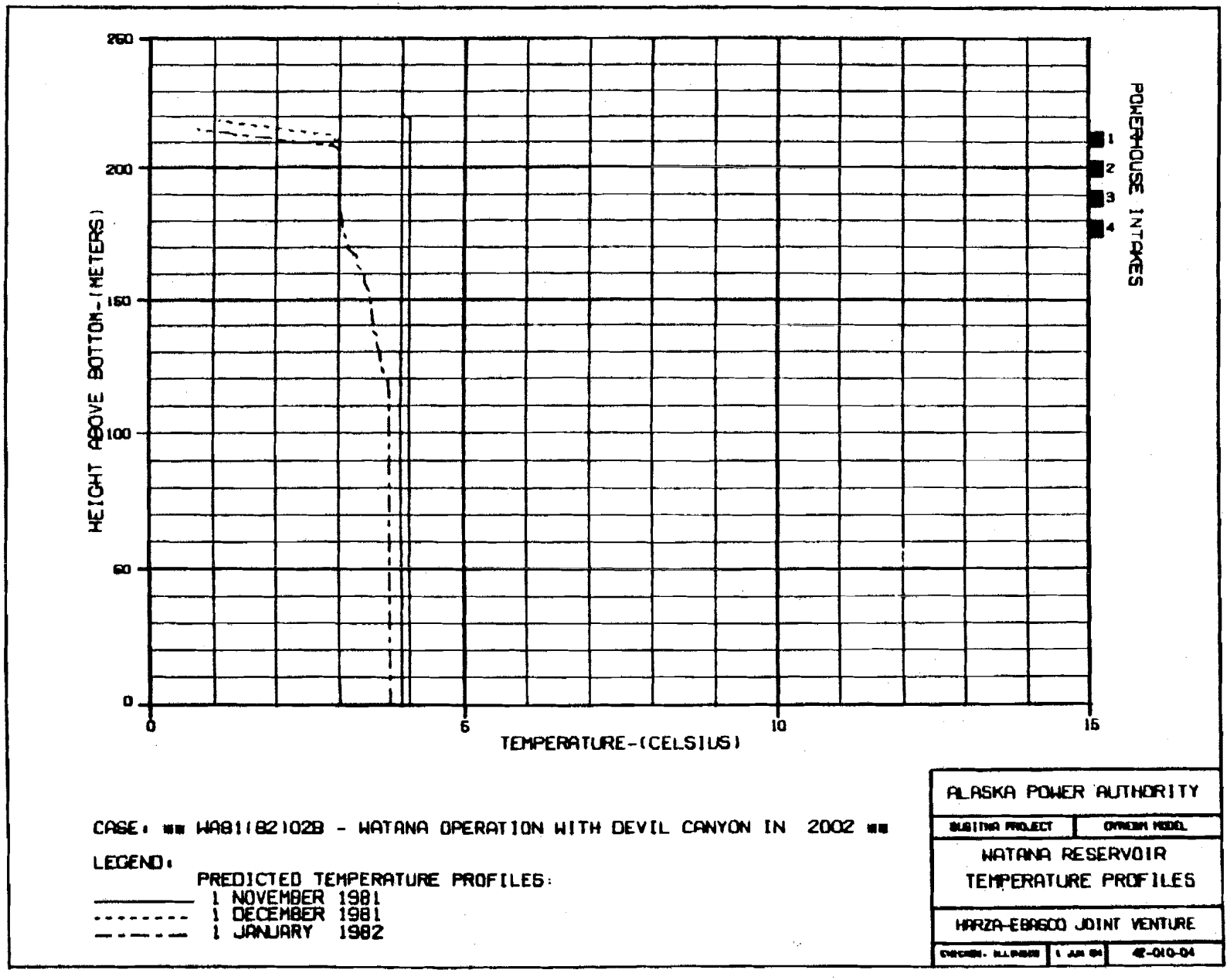
PREDICTED TEMPERATURE PROFILES:

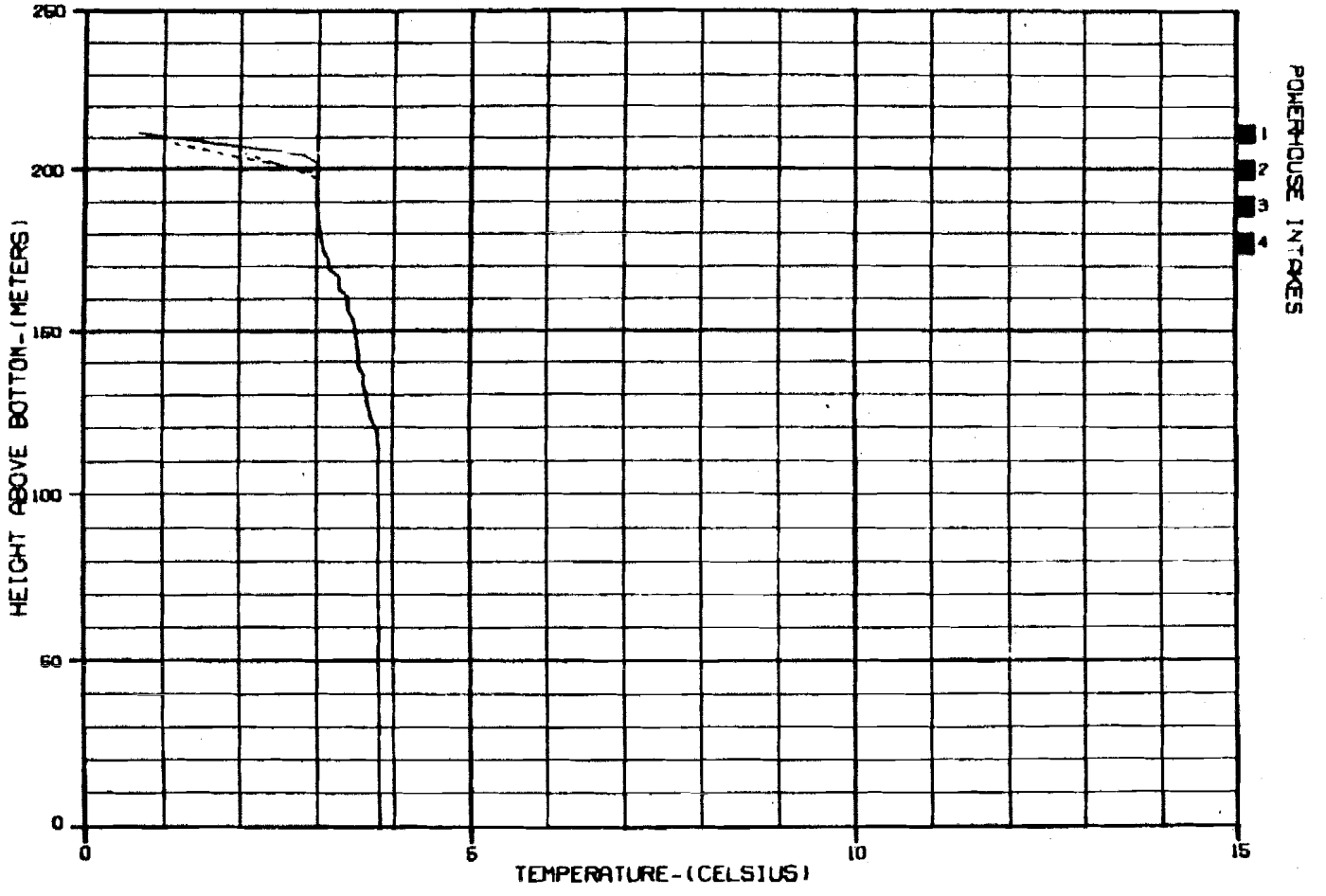
———— 1 AUGUST 1981

- - - - - - - - 1 SEPTEMBER 1981

—·—·— 1 OCTOBER 1981

ALASKA POWER AUTHORITY	
SUSITNA PROJECT	DIVISION HDQ.
WATANA RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
DRAWING NO.	1 JAN 84	4E-010-04


HEIGHT ABOVE BOTTOM-(METERS)
260
200
150
100
50
0
0
5
10
15
TEMPERATURE-(CELSIUS)
POWERHOUSE INTAKES
1
2
3
4
CASE: WA81182102B - WATANA OPERATION WITH DEVIL CANYON IN 2002
LEGEND:
PREDICTED TEMPERATURE PROFILES:
1 NOVEMBER 1981
1 DECEMBER 1981
1 JANUARY 1982
ALASKA POWER AUTHORITY
SUSITNA PROJECT
WATANA RESERVOIR
TEMPERATURE PROFILES
HARZA-EBASCO JOINT VENTURE



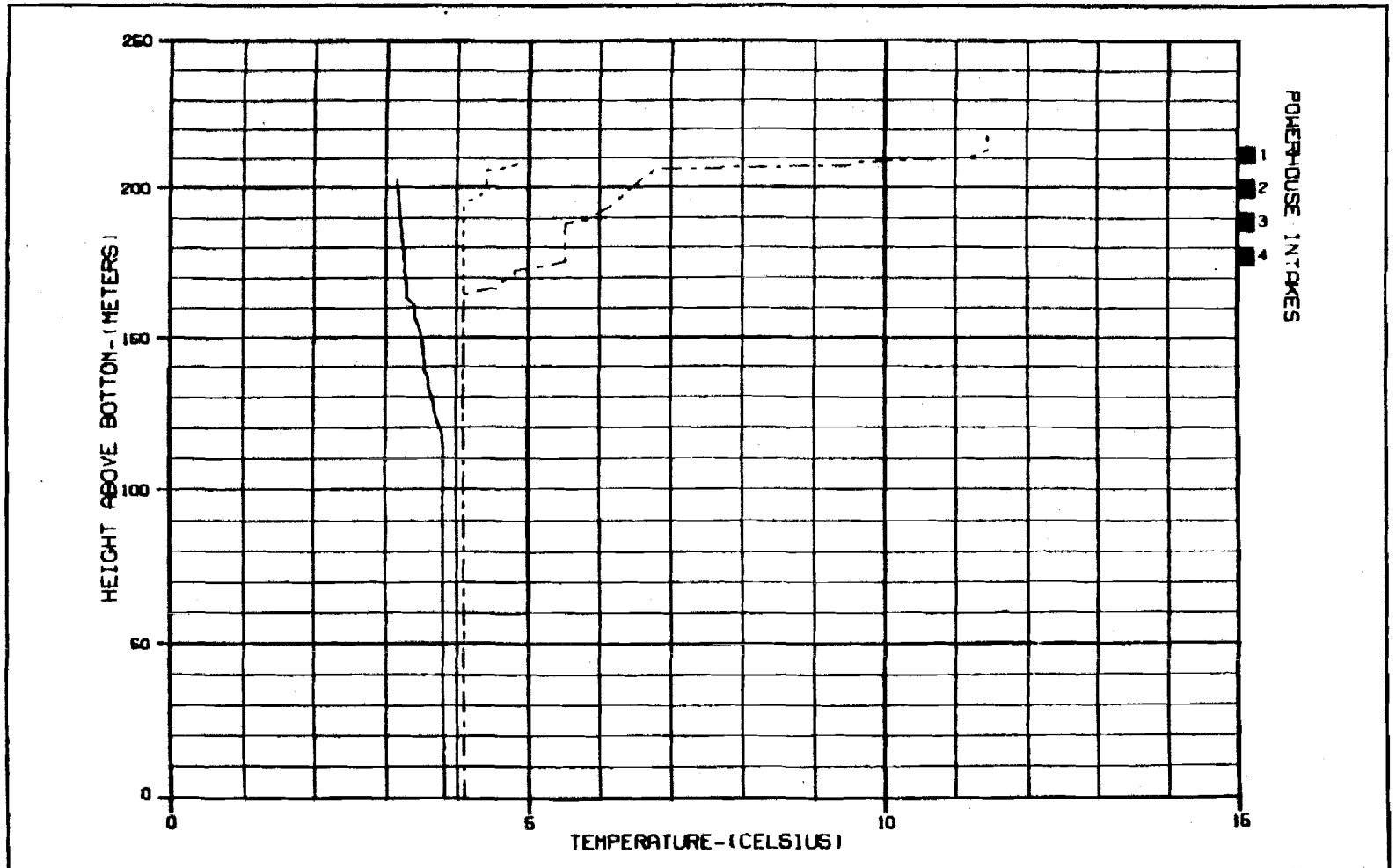
CASE: ** WA81(821028 - WATANA OPERATION WITH DEVIL CANYON IN 2002 **

LEGEND:

PREDICTED TEMPERATURE PROFILES

———— : FEBRUARY 1982
- - - - - - - - : MARCH 1982
— — — — : APRIL 1982

ALASKA POWER AUTHORITY	
SUSITNA PROJECT	DYNSIM MODEL
WATANA RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
[illegible]	1 JAN 84
	42-010-04



CASE: == WAB11821028 - WATANA OPERATION WITH DEVIL CANYON IN 2002 ==

LEGEND:

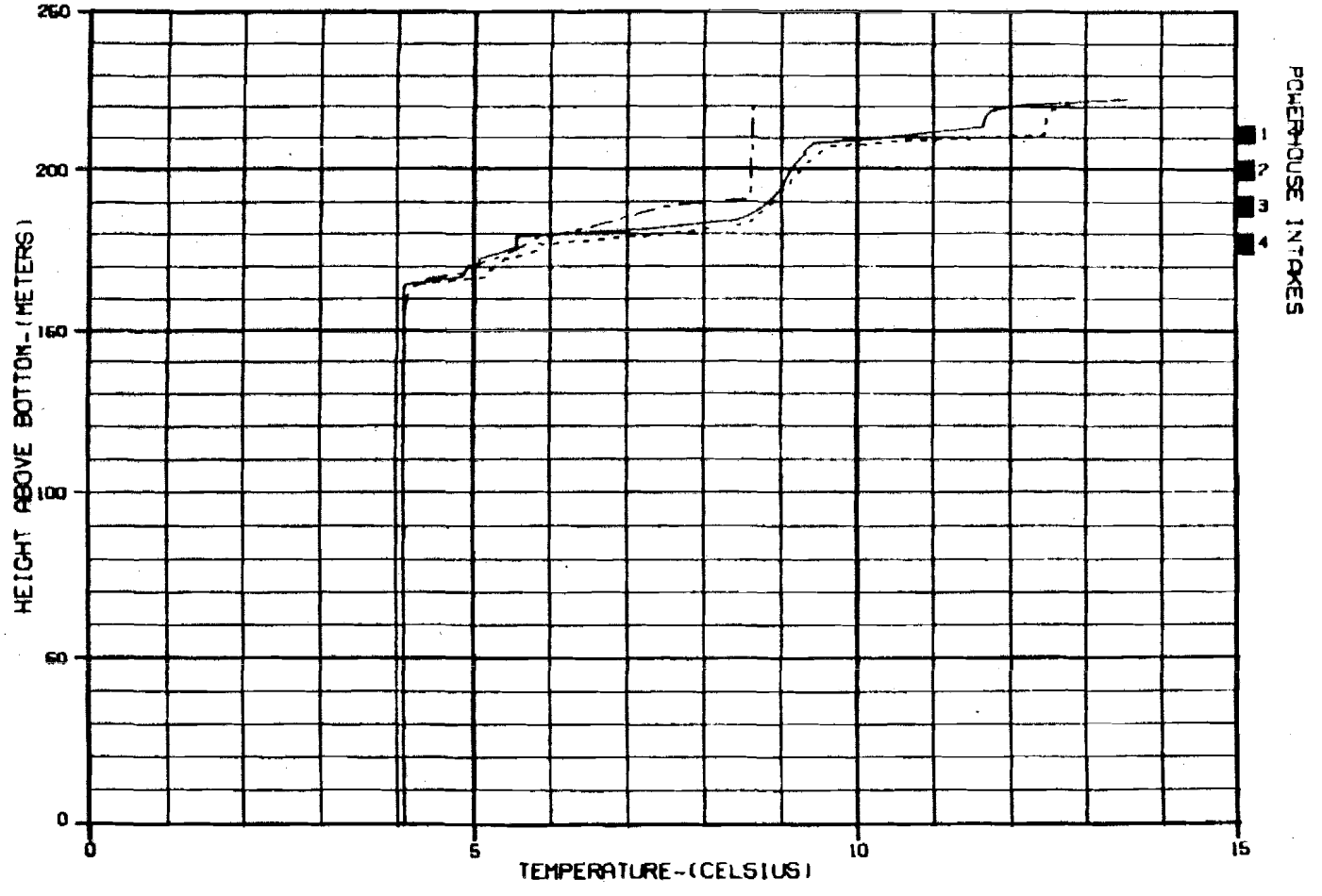
PREDICTED TEMPERATURE PROFILES:

———— 1 MAY 1982

- - - - - - - - 1 JUNE 1982

— — - — — 1 JULY 1982

ALASKA POWER AUTHORITY		
SUSITNA PROJECT	DYRESM MODEL	
WATANA RESERVOIR TEMPERATURE PROFILES		
HARZA-EBASCO JOINT VENTURE		
DRAWING NUMBER	1 JAN 84	42-010-04



CASE: ■■ WAB1(82)02B - WATANA OPERATION WITH DEVIL CANYON IN 2002 ■■

LEGEND:

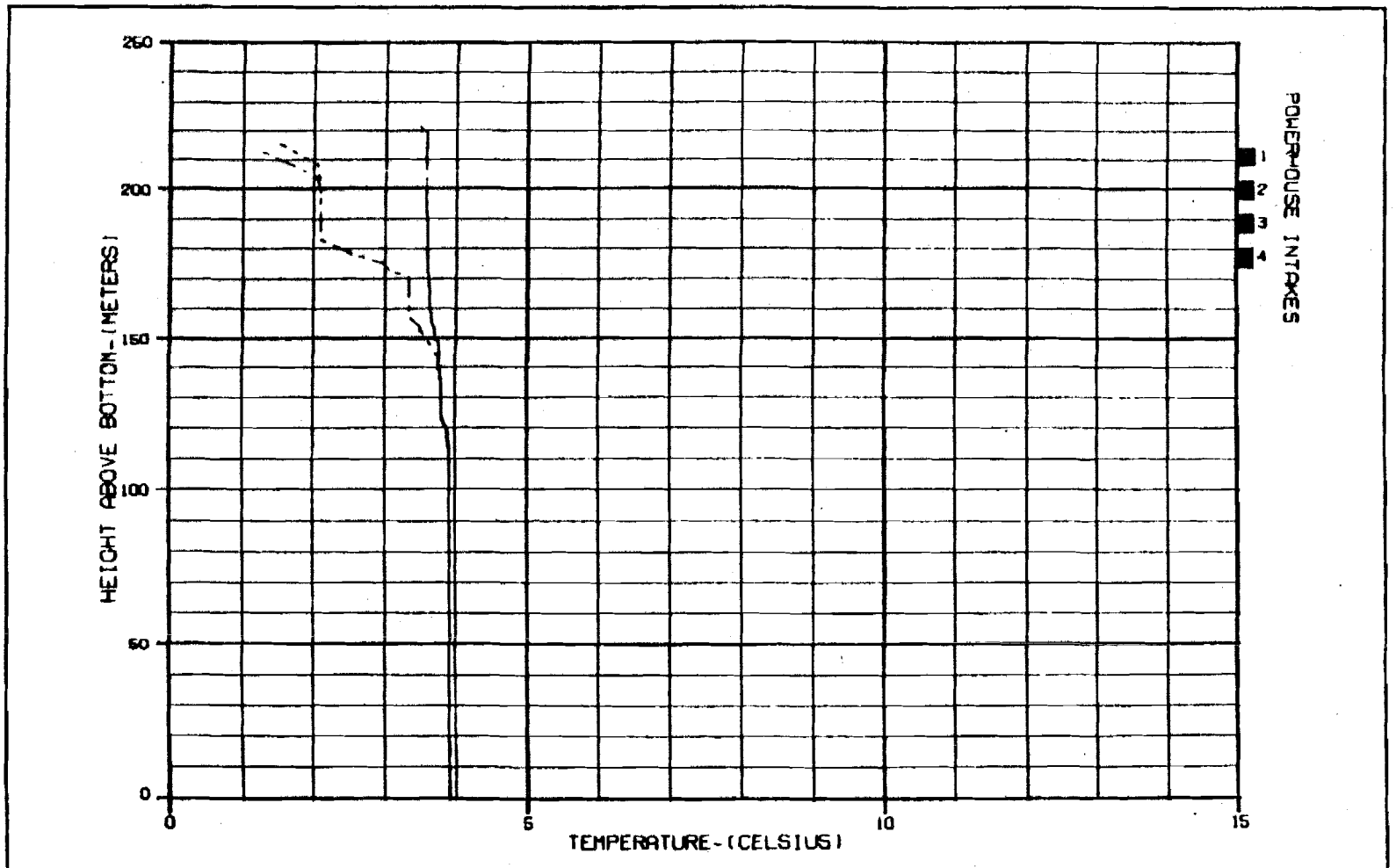
PREDICTED TEMPERATURE PROFILES

———— 1 AUGUST 1982

- - - - - - - - 1 SEPTEMBER 1982

—·—·— 1 OCTOBER 1982

ALASKA POWER AUTHORITY	
SUSITNA PROJECT	DYNSIM MODEL
WATANA RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
CHICAGO, ILLINOIS	1 JAN 84
	4E-010-04



CASE: *** WA811821028 - WATANA OPERATION WITH DEVIL CANYON IN 2002 ***

LEGEND:

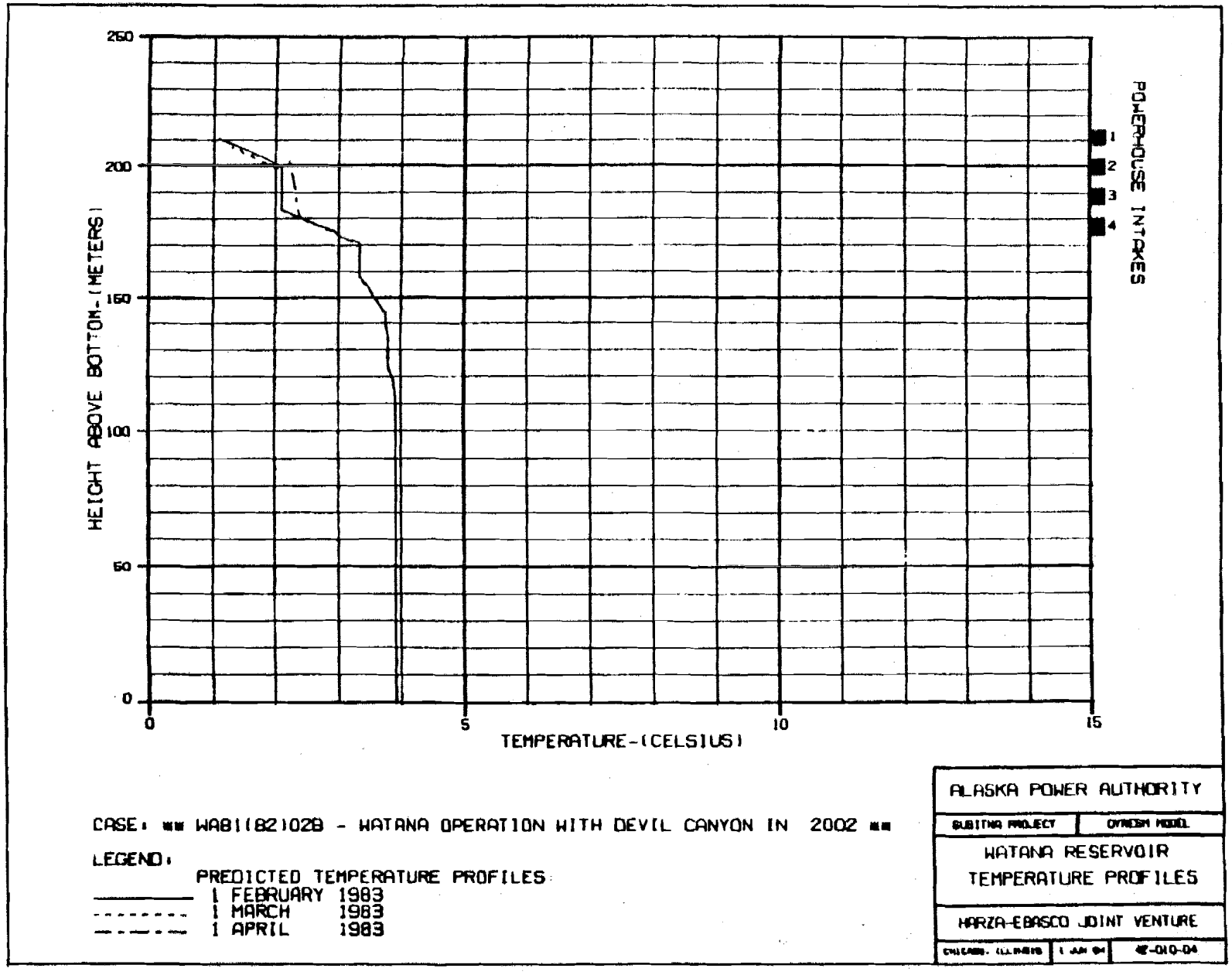
PREDICTED TEMPERATURE PROFILES

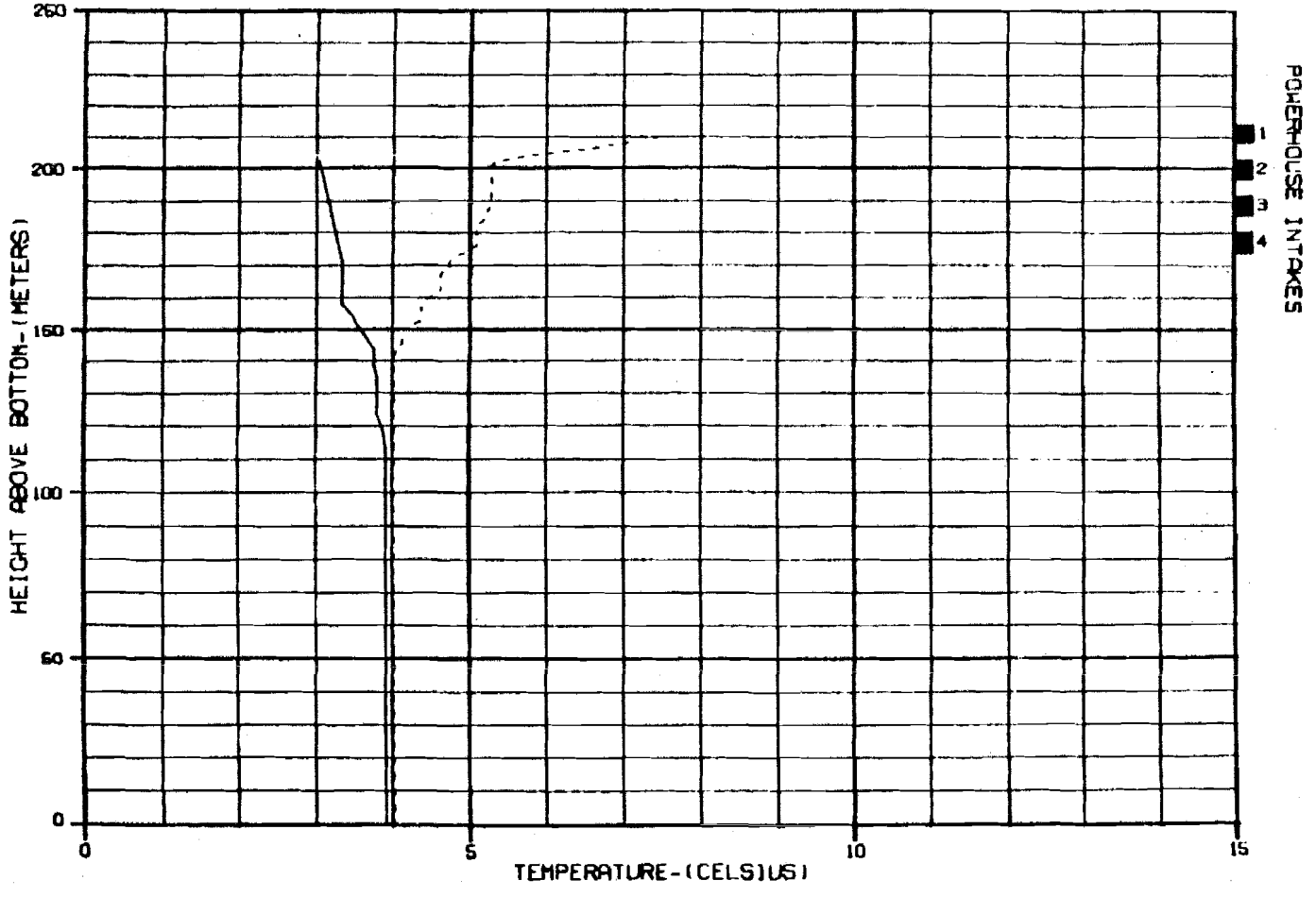
———— 1 NOVEMBER 1982

- - - - - - - - 1 DECEMBER 1982

— - — - — 1 JANUARY 1983

ALASKA POWER AUTHORITY		
SUSITNA PROJECT	DYRESM MODEL	
WATANA RESERVOIR TEMPERATURE PROFILES		
HARZA-EBASCO JOINT VENTURE		
CHICAGO, ILLINOIS	1 JAN 84	42-010-04


250
200
150
100
50
0
HEIGHT ABOVE BOTTOM-(METERS)
0
5
10
15
TEMPERATURE-(CELSIUS)
POWERHOUSE INTAKES
1
2
3
4
CASE: WA81(82)02B - WATANA OPERATION WITH DEVIL CANYON IN 2002
LEGEND:
PREDICTED TEMPERATURE PROFILES
1 FEBRUARY 1983
1 MARCH 1983
1 APRIL 1983
ALASKA POWER AUTHORITY
SUSITNA PROJECT
DYNSIM MODEL
WATANA RESERVOIR
TEMPERATURE PROFILES
HARZA-EBASCO JOINT VENTURE
CHICAGO, ILLINOIS
1 JAN 84
42-010-04



CASE: WAB1(82)02B - WATANA OPERATION WITH DEVIL CANYON IN 2002

LEGEND:

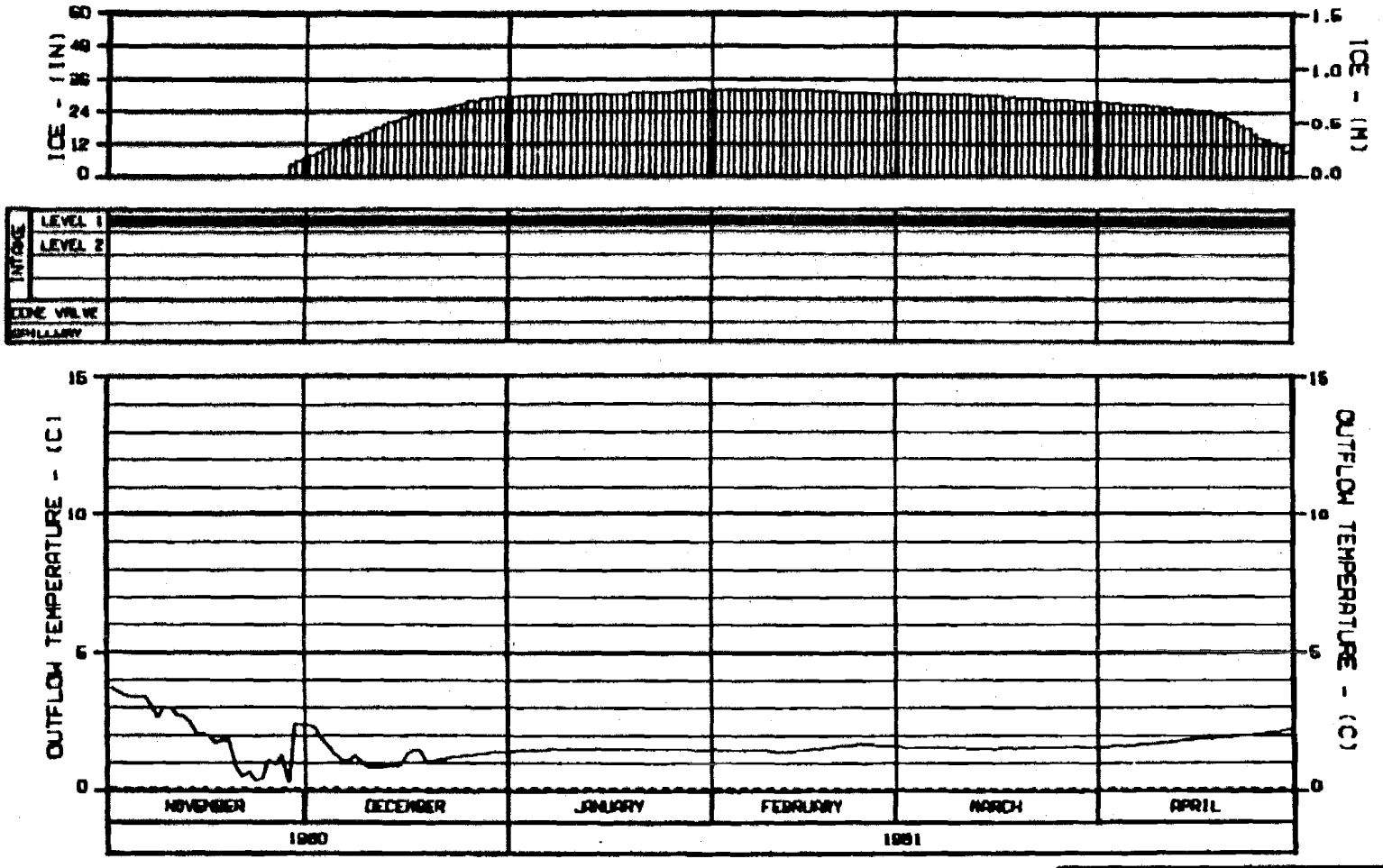
PREDICTED TEMPERATURE PROFILES

———— 1 MAY 1983

- - - - - - - - 1 JUNE 1983

— · — · —

ALASKA POWER AUTHORITY	
SUSITNA PROJECT	DYNIOM MODEL
WATANA RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
CHICAGO, ILLINOIS	1 JUN 84	4E-010-04



LEGEND: CASE: ## DC81182102D - DEVIL CANYON OPERATION WITH WATANA IN 2002 ##
- WATANA WEATHER STATION DATA

———— PREDICTED OUTFLOW TEMPERATURE FROM DEVIL CANYON RESERVOIR

- - - - - - - INFLOW TEMPERATURE TO WATANA RESERVOIR

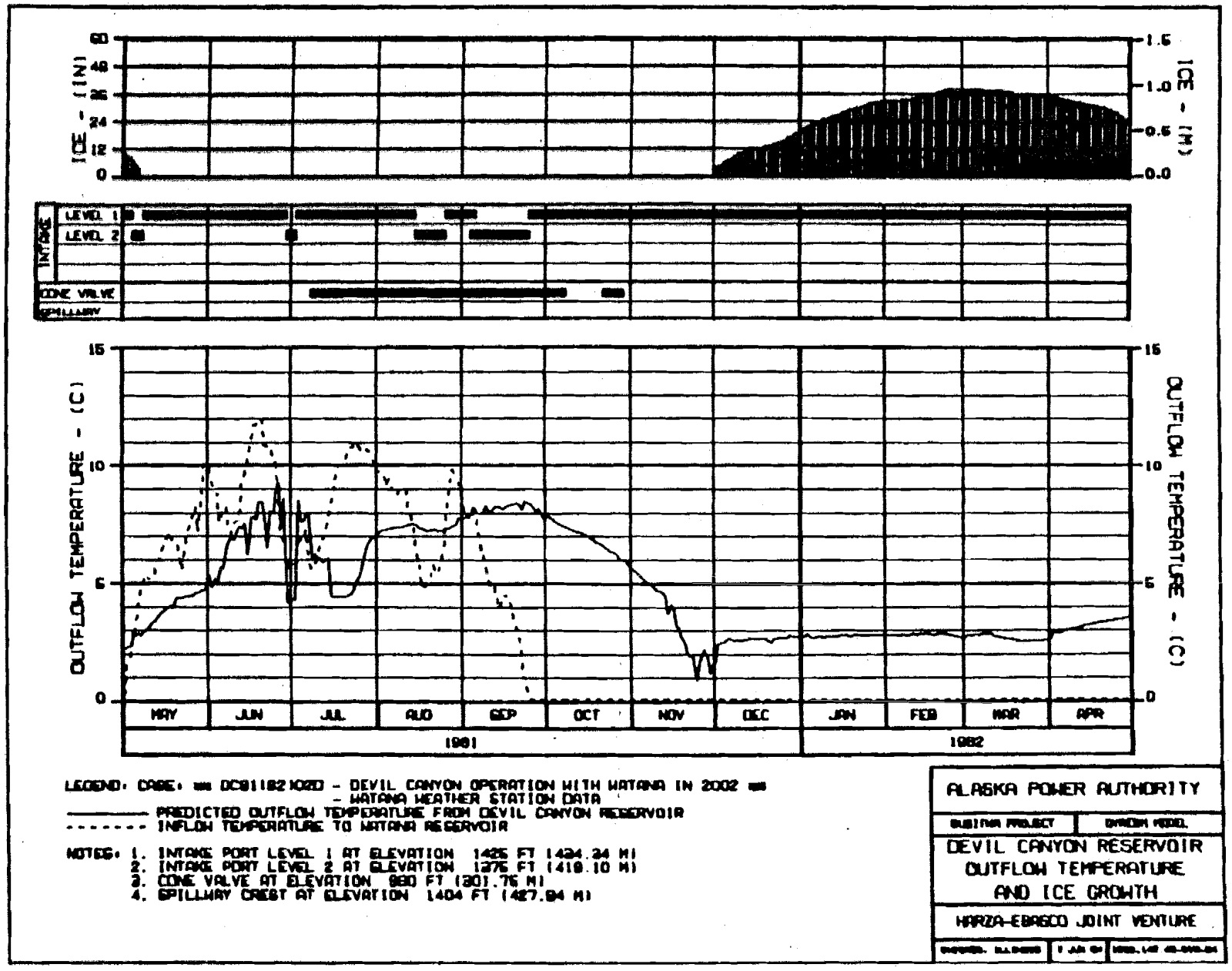
NOTES: 1. INTAKE PORT LEVEL 1 AT ELEVATION 1426 FT (434.34 M)
2. INTAKE PORT LEVEL 2 AT ELEVATION 1376 FT (419.10 M)
3. CONE VALVE AT ELEVATION 990 FT (301.75 M)
4. SPILLWAY CREST AT ELEVATION 1404 FT (427.94 M)

ALASKA POWER AUTHORITY

SUSITNA PROJECT | DEVIL CANYON

DEVIL CANYON RESERVOIR
OUTFLOW TEMPERATURE
AND ICE GROWTH

HARZA-EBASCO JOINT VENTURE



LEGEND: CASE: DC81182102D - DEVIL CANYON OPERATION WITH WATANA IN 2002
- WATANA WEATHER STATION DATA

——— PREDICTED OUTFLOW TEMPERATURE FROM DEVIL CANYON RESERVOIR

- - - - - - - INFLOW TEMPERATURE TO WATANA RESERVOIR

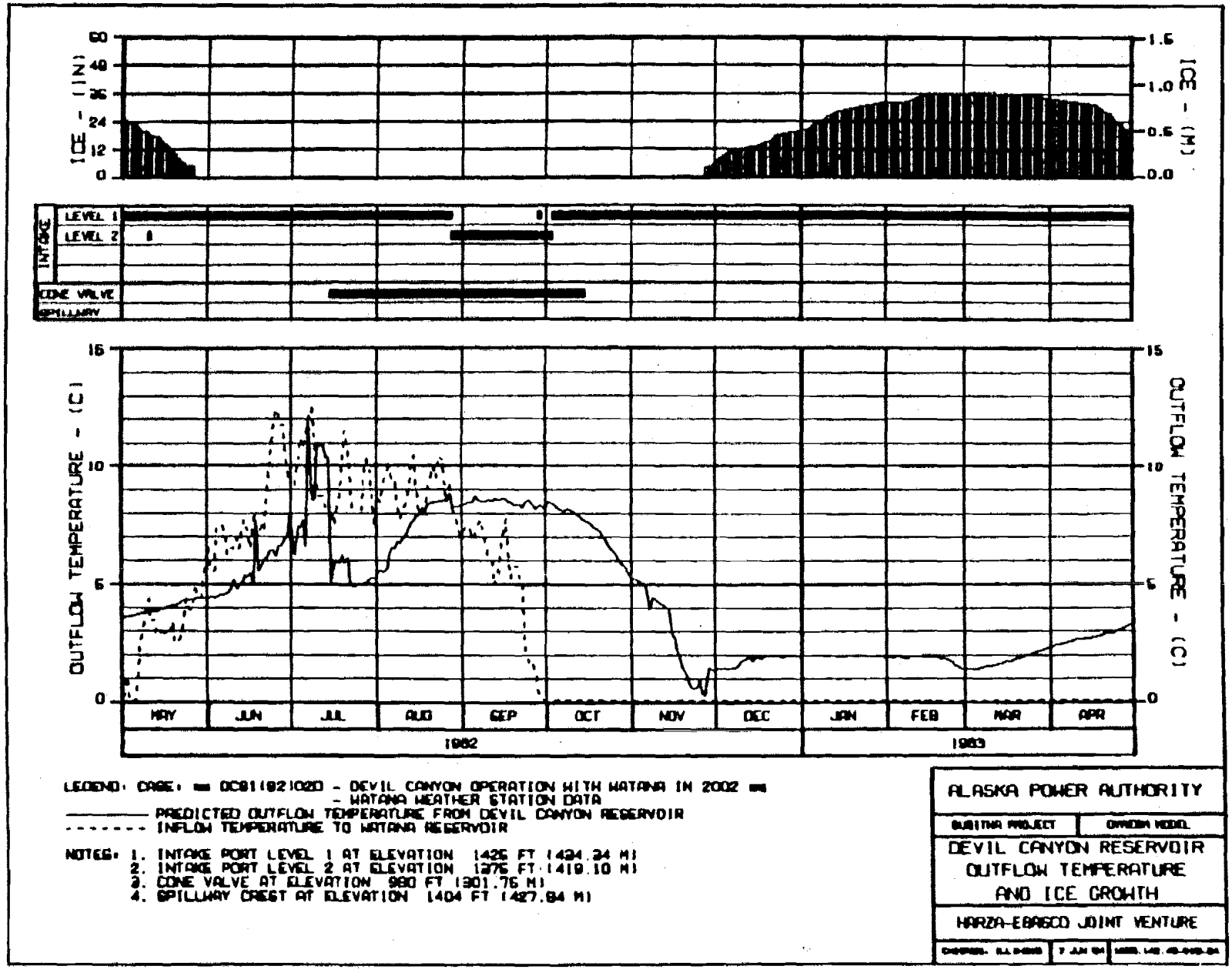
NOTES: 1. INTAKE PORT LEVEL 1 AT ELEVATION 1425 FT (434.34 M)
2. INTAKE PORT LEVEL 2 AT ELEVATION 1375 FT (419.10 M)
3. CONE VALVE AT ELEVATION 980 FT (301.76 M)
4. SPILLWAY CREST AT ELEVATION 1404 FT (427.94 M)

ALASKA POWER AUTHORITY

SUSITNA PROJECT | BYRON MODEL

DEVIL CANYON RESERVOIR
OUTFLOW TEMPERATURE
AND ICE GROWTH

HARZA-EBASCO JOINT VENTURE



LEGEND: CASE: DC81102102D - DEVIL CANYON OPERATION WITH WATANA IN 2002
- WATANA WEATHER STATION DATA

———— PREDICTED OUTFLOW TEMPERATURE FROM DEVIL CANYON RESERVOIR

- - - - - - - INFLOW TEMPERATURE TO WATANA RESERVOIR

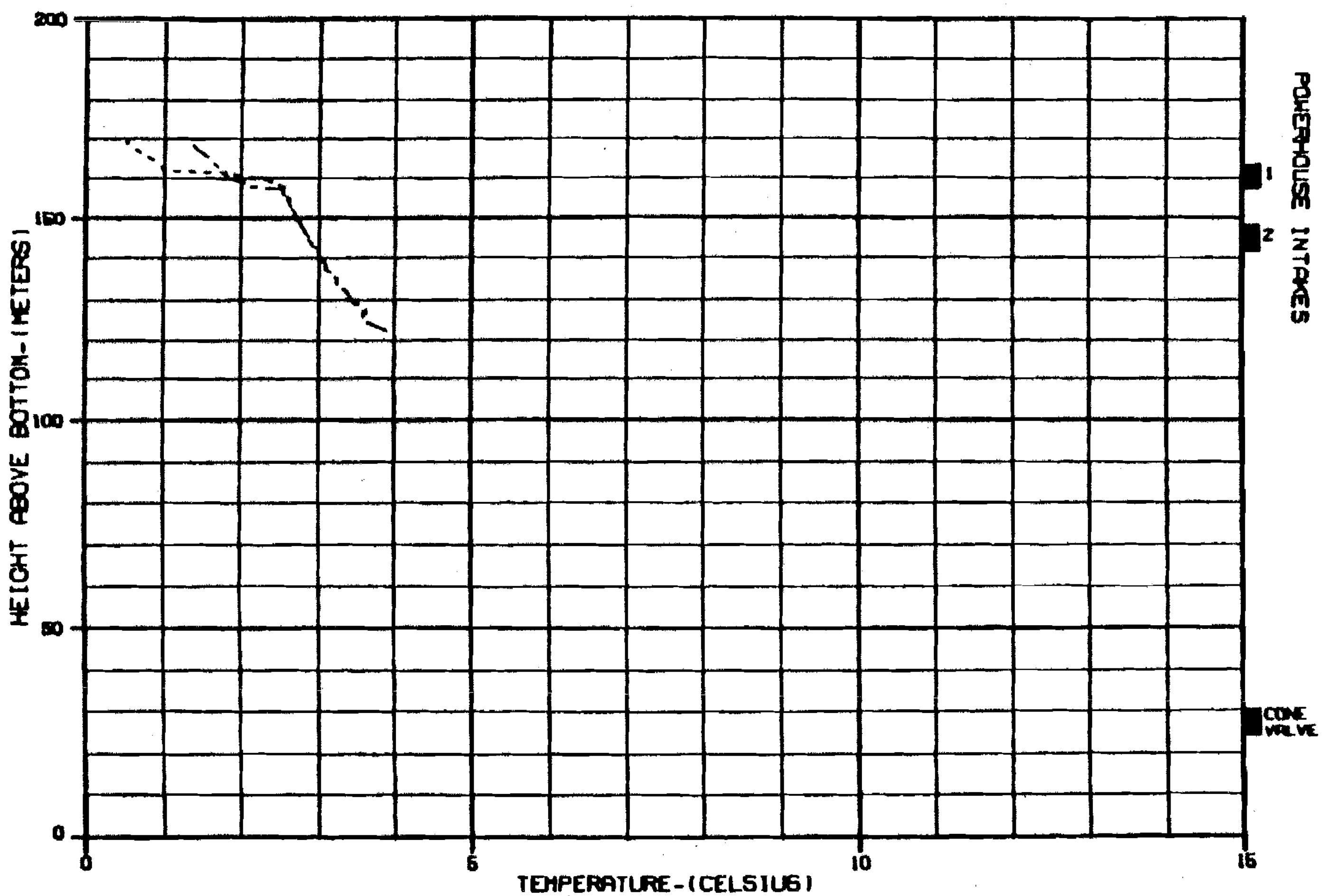
NOTES:
1. INTAKE PORT LEVEL 1 AT ELEVATION 1425 FT (434.34 M)
2. INTAKE PORT LEVEL 2 AT ELEVATION 1375 FT (419.10 M)
3. CONE VALVE AT ELEVATION 980 FT (301.76 M)
4. SPILLWAY CREST AT ELEVATION 1404 FT (427.84 M)

ALASKA POWER AUTHORITY

SUSITNA PROJECT | OMEGA MODEL

DEVIL CANYON RESERVOIR
OUTFLOW TEMPERATURE
AND ICE GROWTH

HARZA-EBASCO JOINT VENTURE



CASE: ** DC811821020 - DEVIL CANYON OPERATION WITH WATANA IN 2002 **
- WATANA WEATHER STATION DATA

LEGEND:

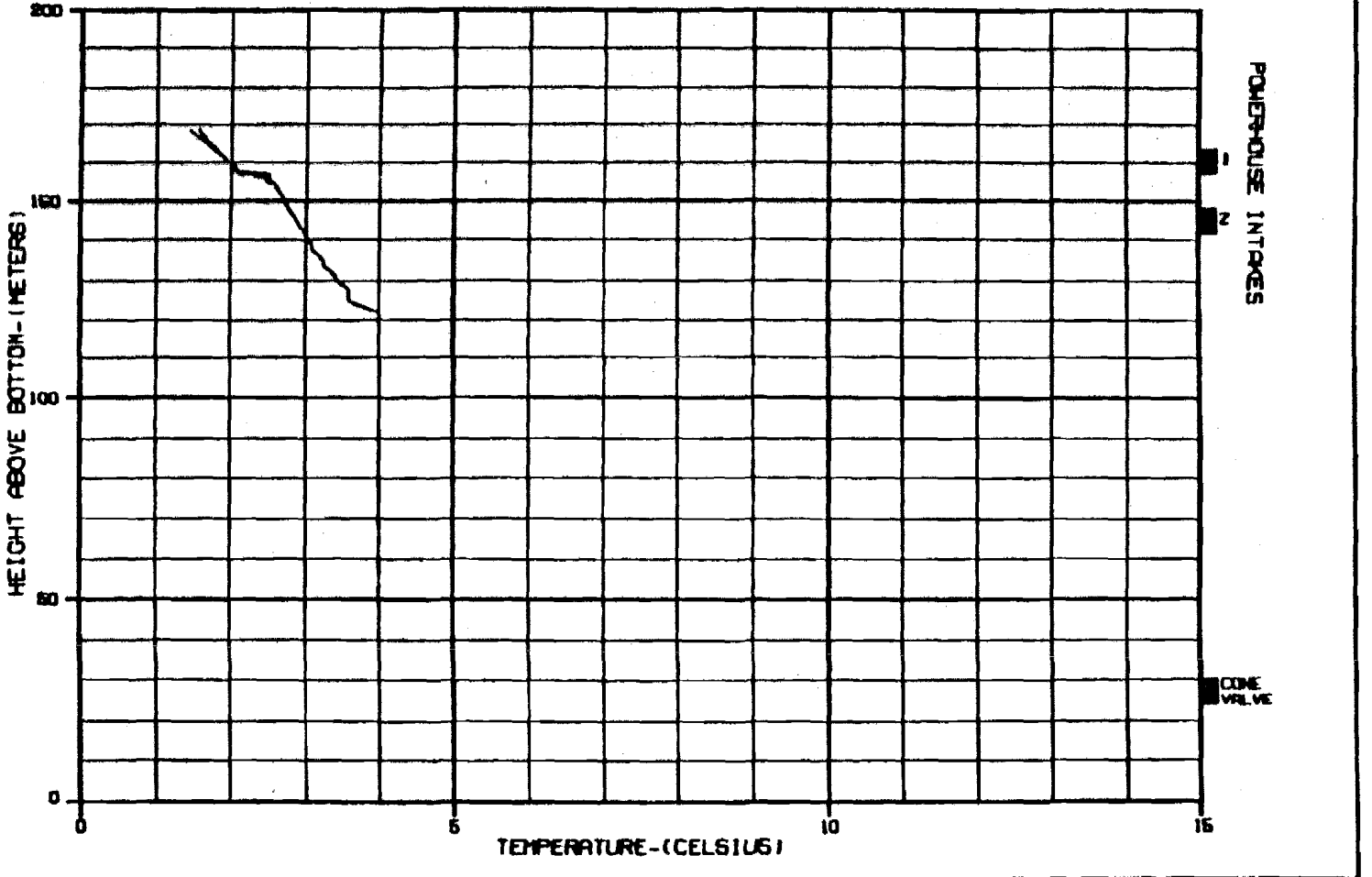
PREDICTED TEMPERATURE PROFILES

———— 1 NOVEMBER 1980

- - - - - - 1 DECEMBER 1980

— - — - — 1 JANUARY 1981

ALASKA POWER AUTHORITY	
SUSITNA PROJECT	DYRESM MODEL
DEVIL CANYON RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
[illegible]	[illegible]	42-010-04



CASE: DC81(82102D - DEVIL CANYON OPERATION WITH WATANA IN 2002
- WATANA WEATHER STATION DATA

LEGEND:

PREDICTED TEMPERATURE PROFILES:

———— 1 FEBRUARY 1981
- - - - - - - - 1 MARCH 1981
— - — - — 1 APRIL 1981

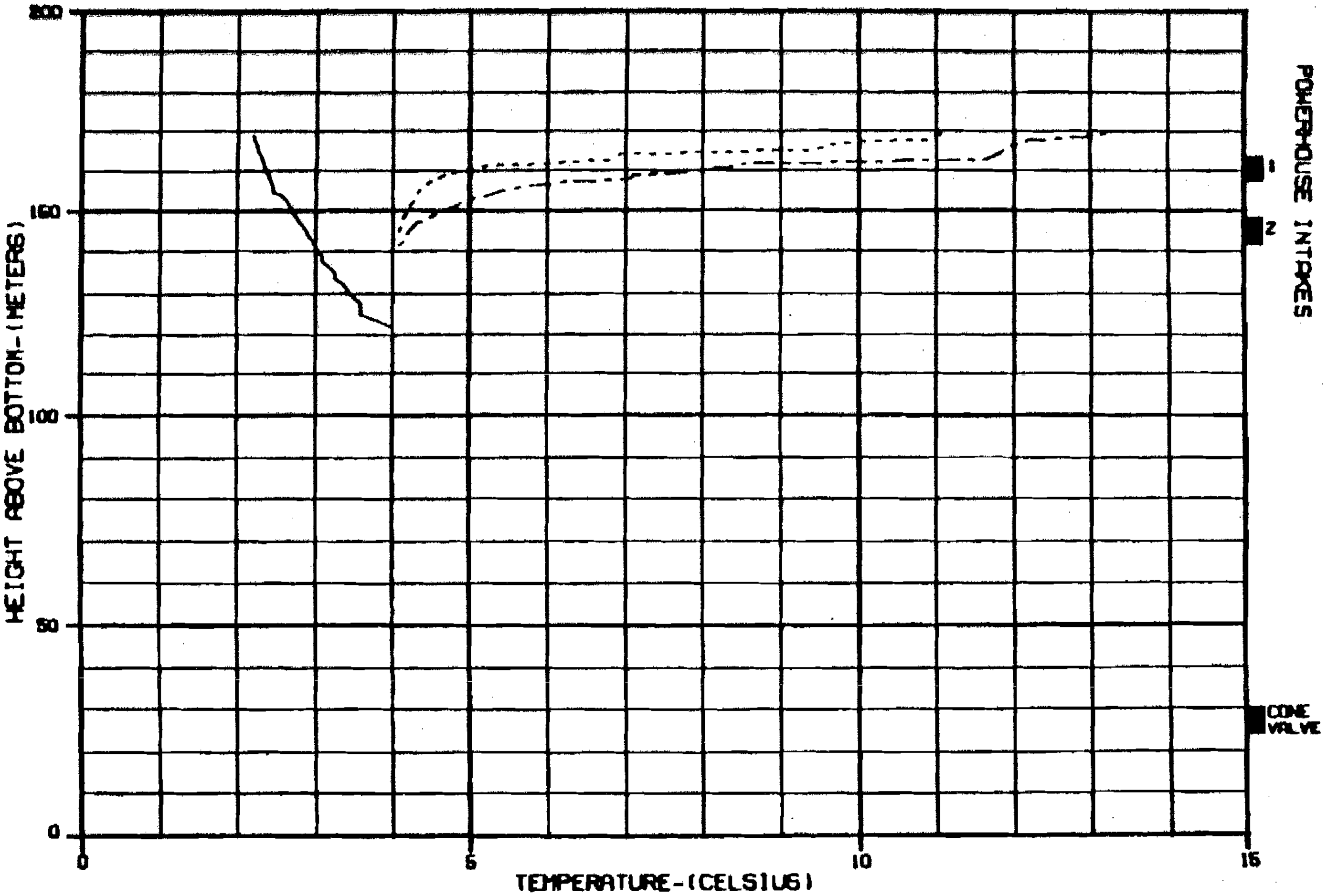
ALASKA POWER AUTHORITY

SUSITNA PROJECT | DIVISION HEDB.

DEVIL CANYON RESERVOIR TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

DRAWING NUMBER | 7 JAN 84 | 42-210-04



CASE: ** DCB1(82)02D - DEVIL CANYON OPERATION WITH WATANA IN 2002 **
- WATANA WEATHER STATION DATA

LEGEND:

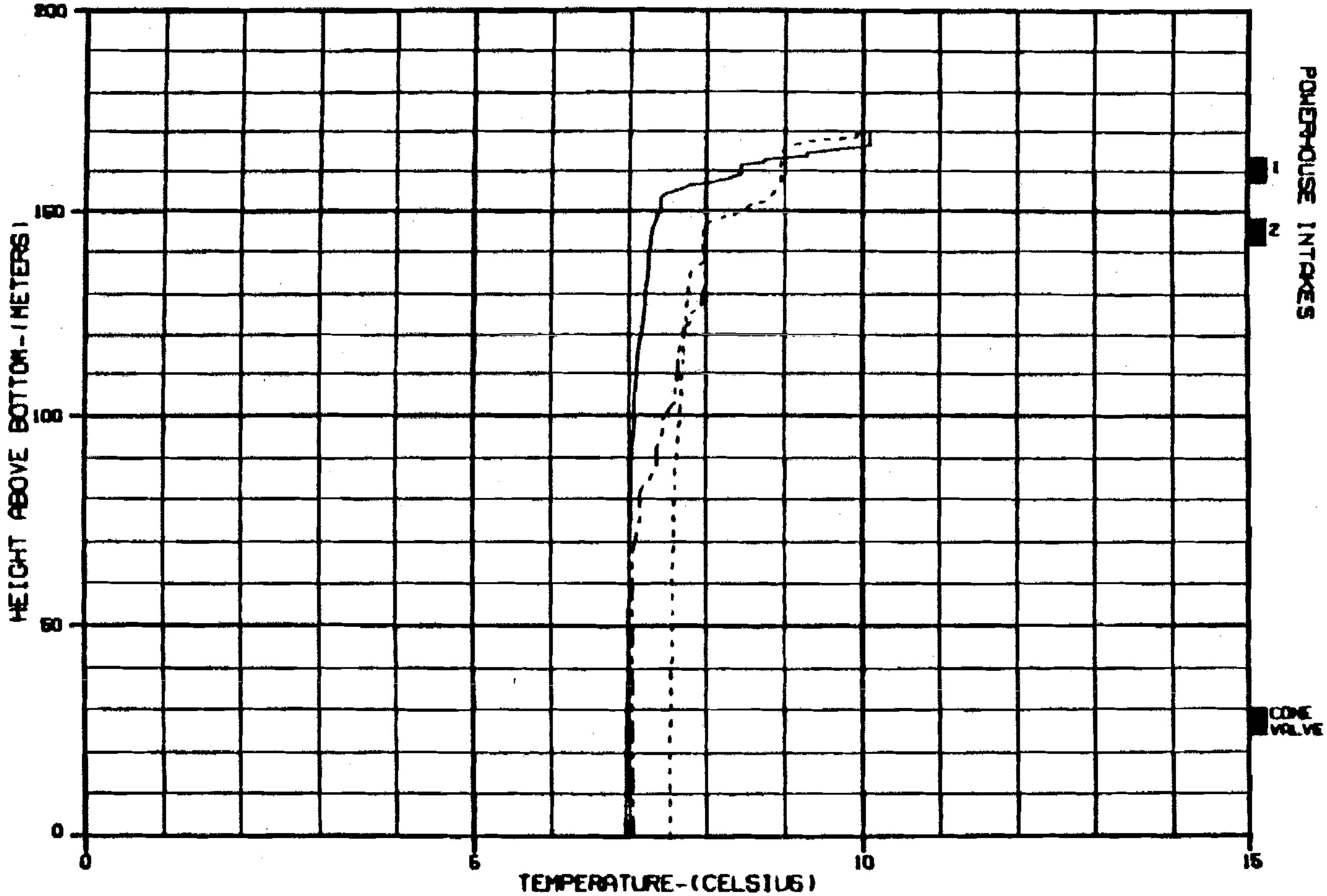
PREDICTED TEMPERATURE PROFILES:

- ———— 1 MAY 1981
- - - - - - 1 JUNE 1981
- —·—·— 1 JULY 1981

ALASKA POWER AUTHORITY

DEVIL CANYON RESERVOIR TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE



CASE: ** DC81(82)020 - DEVIL CANYON OPERATION WITH WATANA IN 2002 **
- WATANA WEATHER STATION DATA

LEGEND:

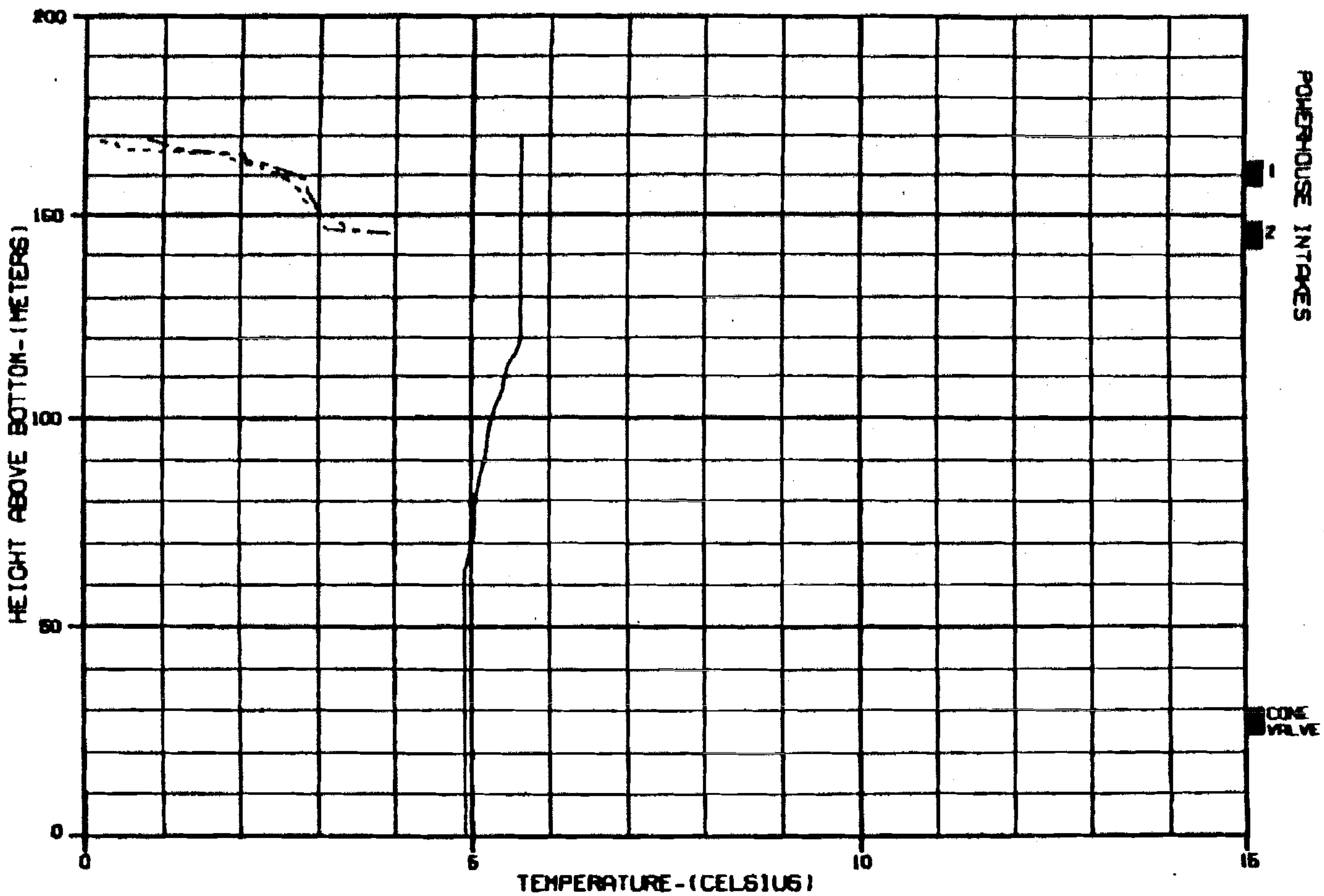
PREDICTED TEMPERATURE PROFILES:

- ———— | AUGUST 1981
- - - - - - | SEPTEMBER 1981
- —-—-— | OCTOBER 1981

ALASKA POWER AUTHORITY

DEVIL CANYON RESERVOIR
TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE



CASE: ** DC81(82)02D - DEVIL CANYON OPERATION WITH WATANA IN 2002 **
- WATANA WEATHER STATION DATA

LEGEND:

PREDICTED TEMPERATURE PROFILES:

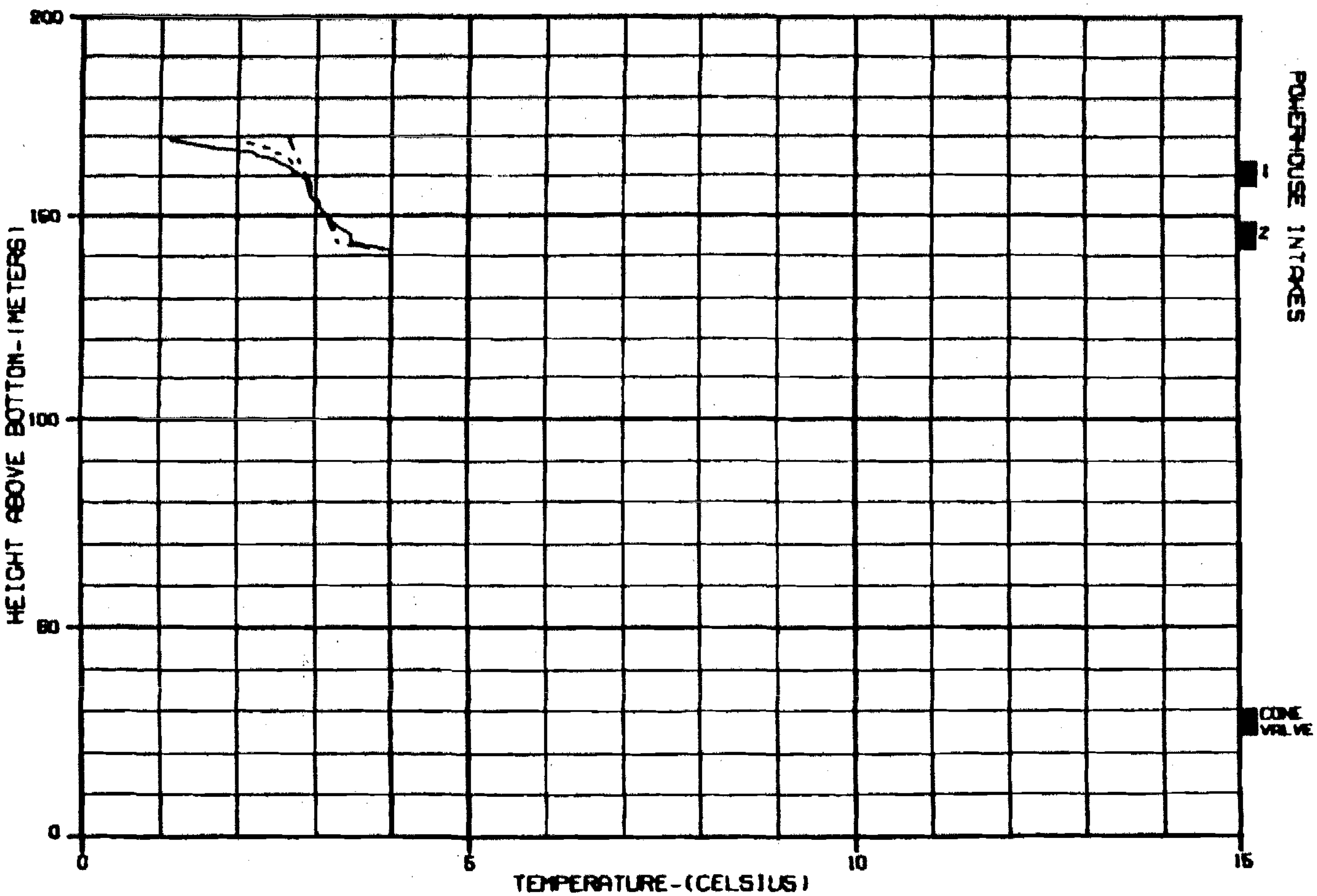
- ———— 1 NOVEMBER 1981
- -------- 1 DECEMBER 1981
- —·—·— 1 JANUARY 1982

ALASKA POWER AUTHORITY

DEVIL CANYON RESERVOIR
TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

42-010-04



CASE: ** DC811821020 - DEVIL CANYON OPERATION WITH WATANA IN 2002 **
- WATANA WEATHER STATION DATA

LEGEND:

PREDICTED TEMPERATURE PROFILES:

———————	1 FEBRUARY	1982
- - - - - - - -	1 MARCH	1982
—·—·—·—	1 APRIL	1982

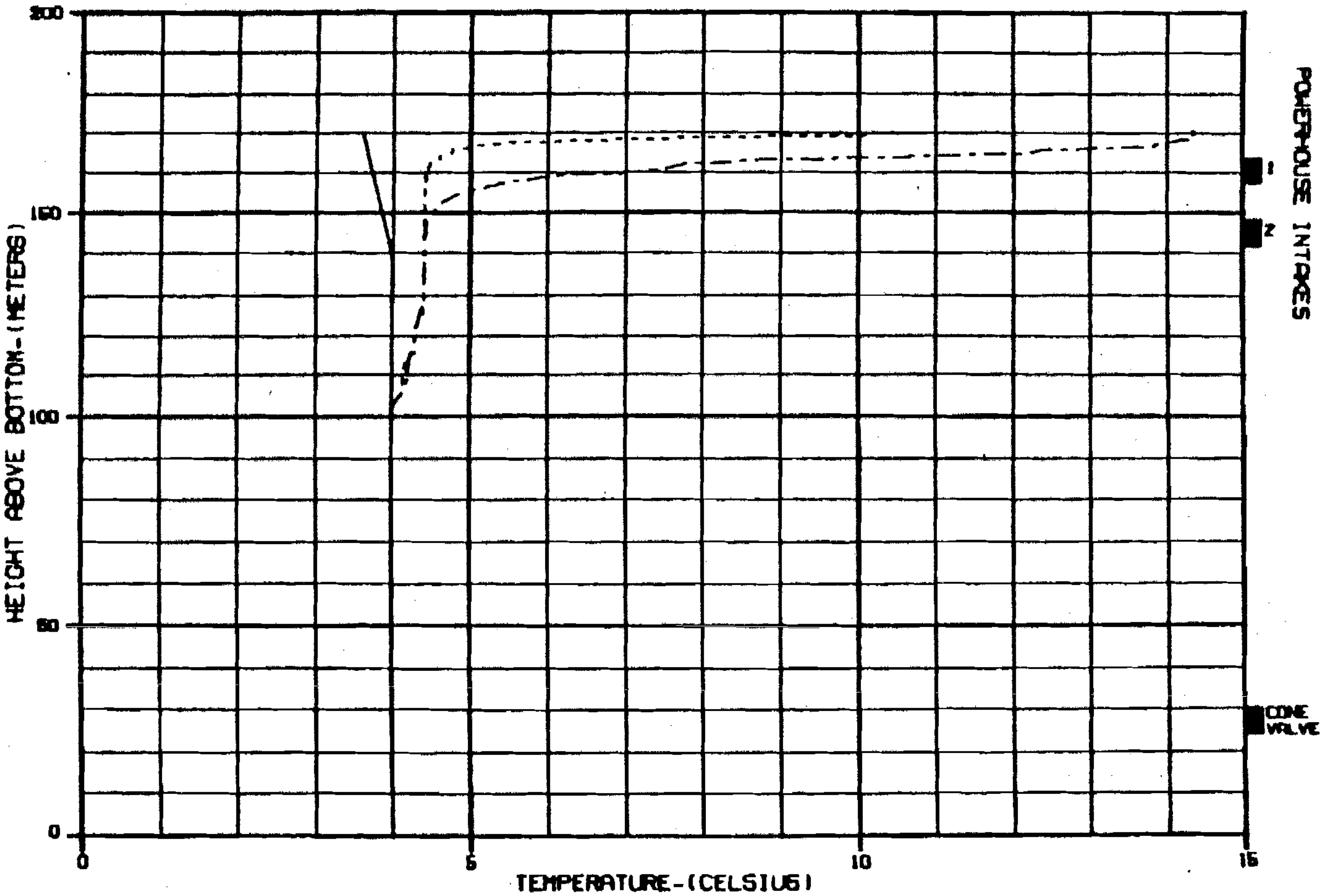
ALASKA POWER AUTHORITY

[illegible]	[illegible]

DEVIL CANYON RESERVOIR
TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

[illegible]	[illegible]	[illegible]



CASE: ** DC811821020 - DEVIL CANYON OPERATION WITH WATANA IN 2002 **
- WATANA WEATHER STATION DATA

LEGEND:

PREDICTED TEMPERATURE PROFILES:

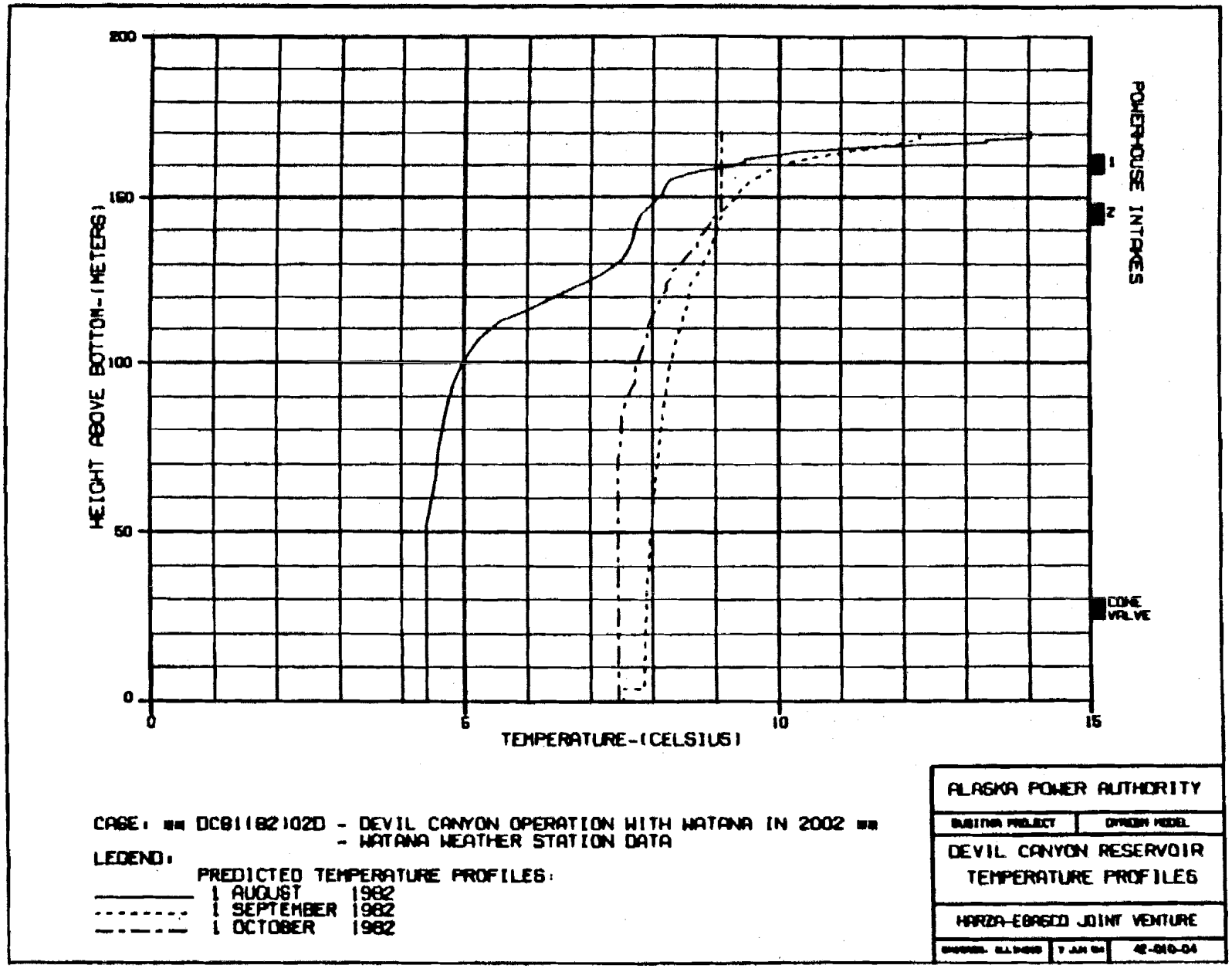
———— 1 MAY 1982
- - - - - - 1 JUNE 1982
—·—·— 1 JULY 1982

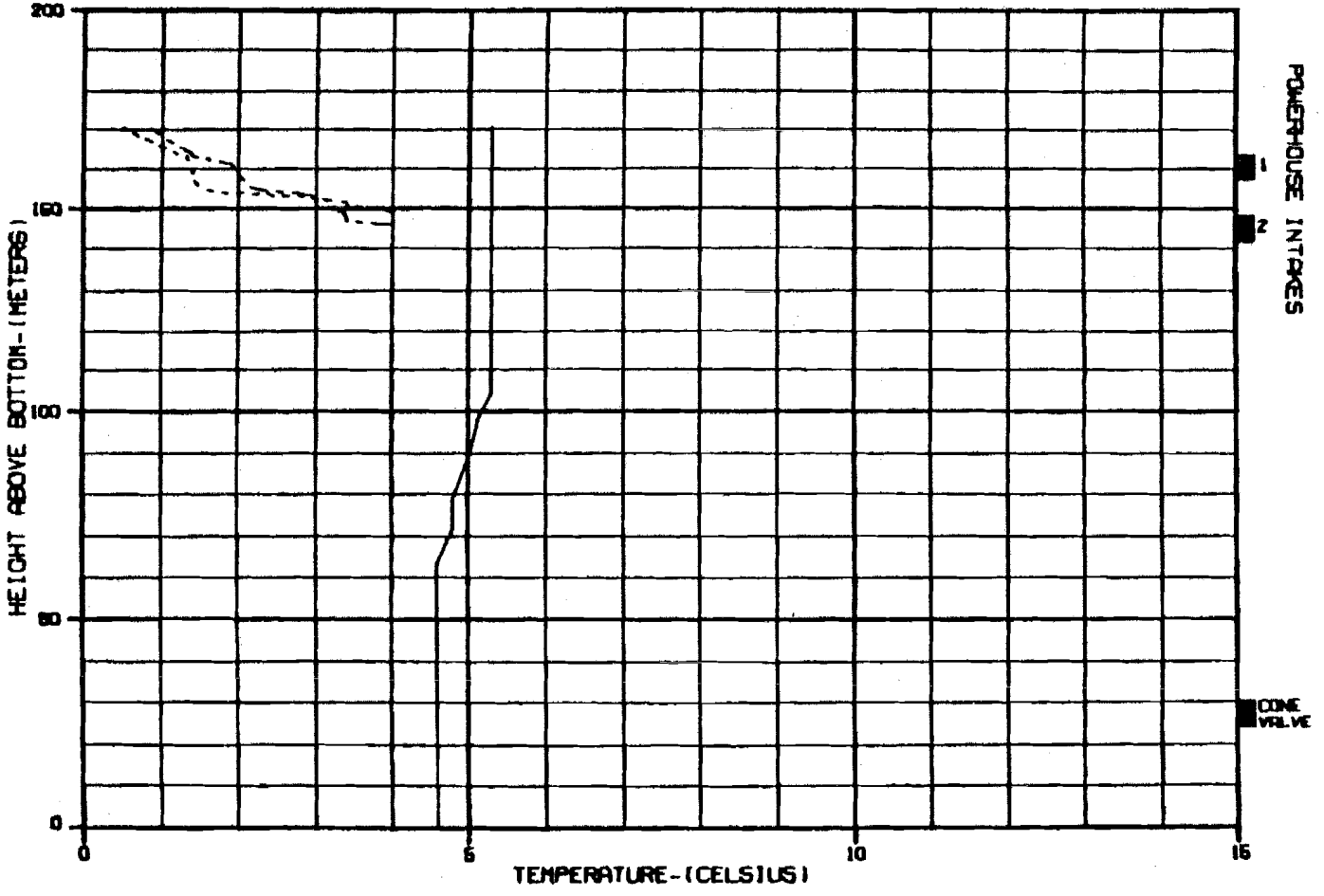
ALASKA POWER AUTHORITY

DEVIL CANYON RESERVOIR TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

48-010-04


200
150
100
50
0
HEIGHT ABOVE BOTTOM-(METERS)
0
5
10
15
TEMPERATURE-(CELSIUS)
POWERHOUSE INTAKES
1
2
CONE VALVE
CASE: == DCB1182102D - DEVIL CANYON OPERATION WITH WATANA IN 2002 ==
- WATANA WEATHER STATION DATA
LEGEND:
PREDICTED TEMPERATURE PROFILES:
1 AUGUST 1982
1 SEPTEMBER 1982
1 OCTOBER 1982
ALASKA POWER AUTHORITY
SUSITNA PROJECT
DIVISION MODEL
DEVIL CANYON RESERVOIR
TEMPERATURE PROFILES
HARZA-EBASCO JOINT VENTURE
7 JAN 84
42-010-04



CASE: == DC81182102D - DEVIL CANYON OPERATION WITH WATANA IN 2002 ==
- WATANA WEATHER STATION DATA

LEGEND:

PREDICTED TEMPERATURE PROFILES:

———— 1 NOVEMBER 1982
- - - - - - - - 1 DECEMBER 1982
—·—·— 1 JANUARY 1983

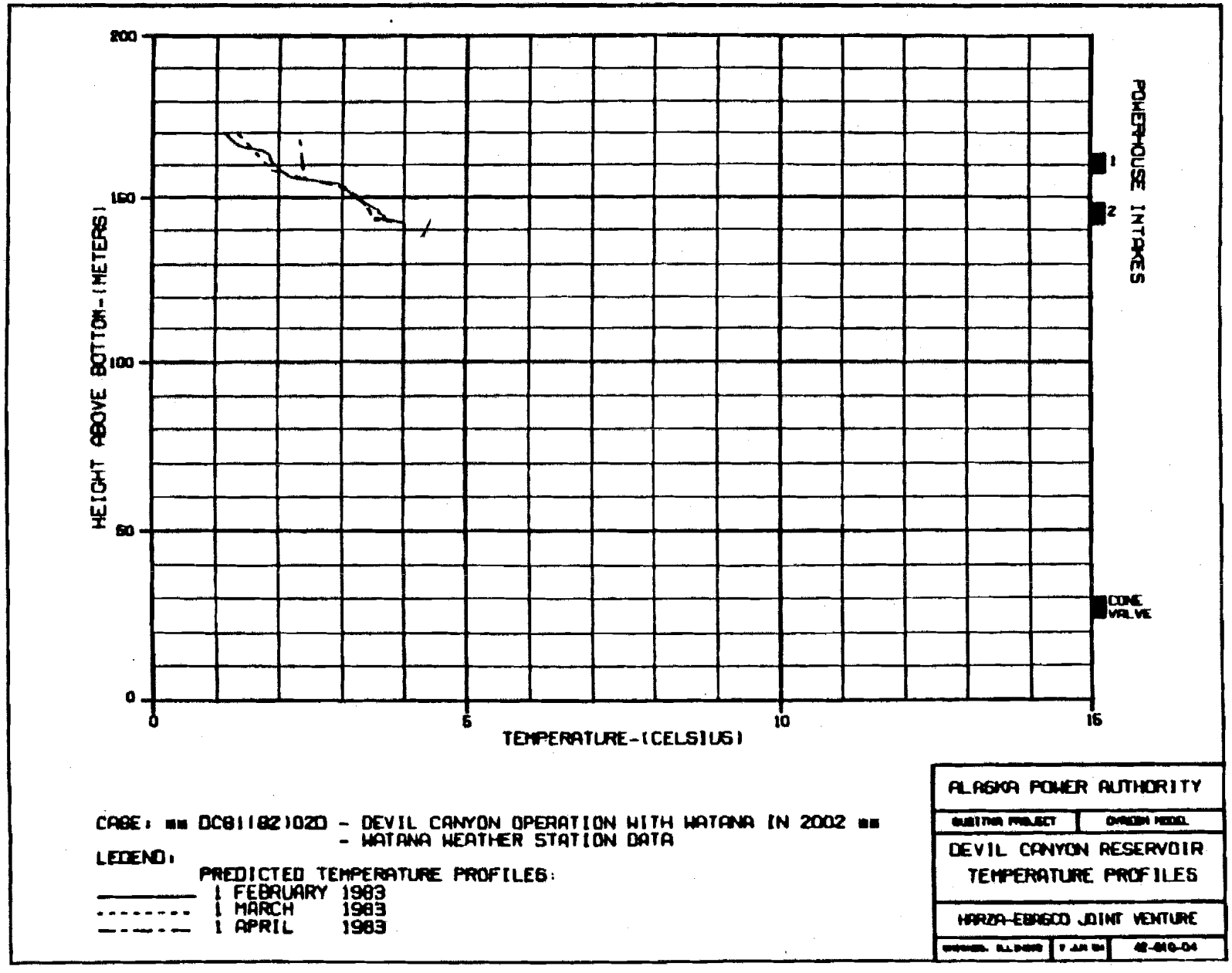
ALASKA POWER AUTHORITY

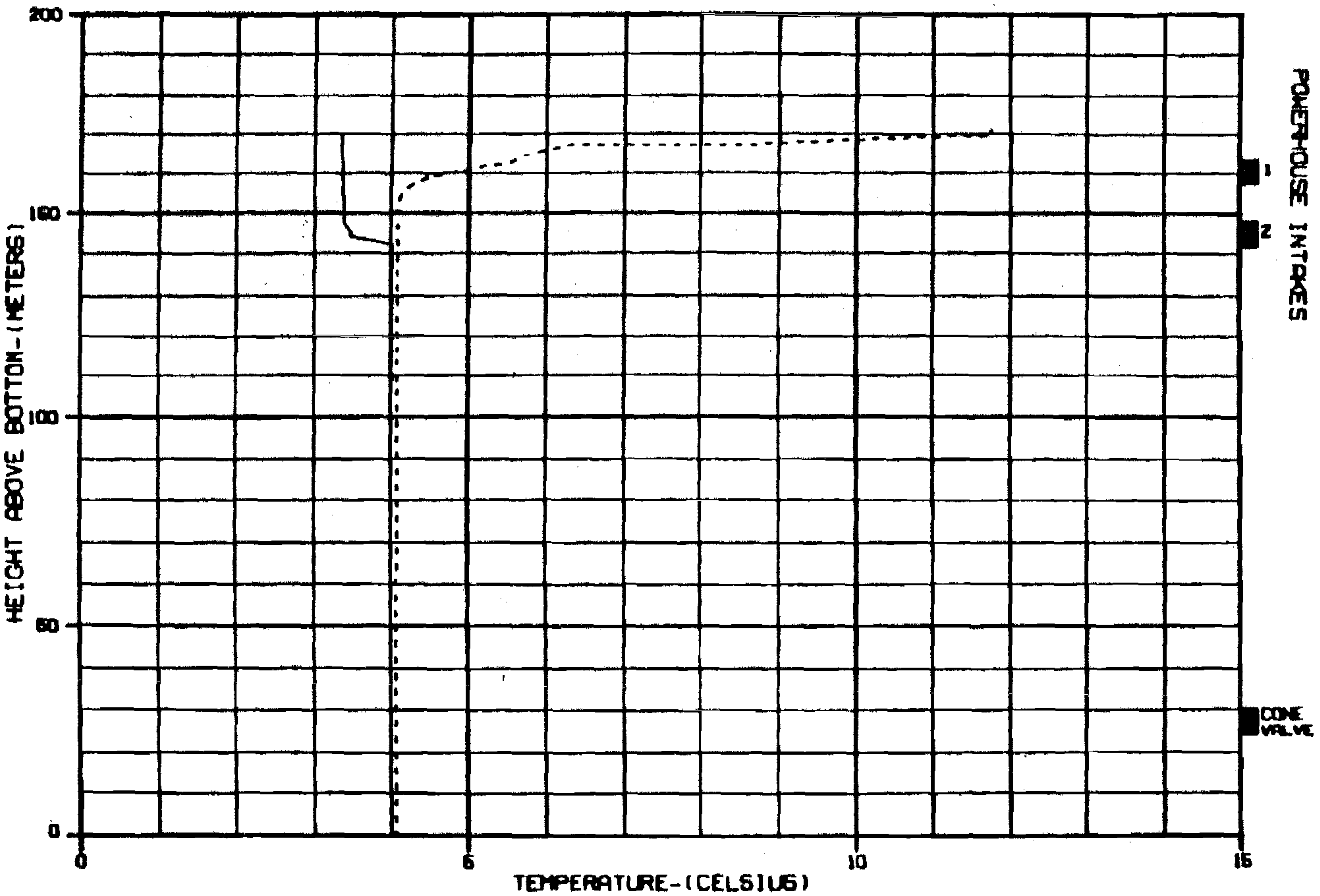
SUSITNA PROJECT | DIVISION HDQ.

DEVIL CANYON RESERVOIR TEMPERATURE PROFILES

HARZA-EBASCO JOINT VENTURE

DRAWING NO. | 7 JAN 84 | 42-010-04


200
150
100
50
0
HEIGHT ABOVE BOTTOM-(METERS)
0
5
10
15
TEMPERATURE-(CELSIUS)
POWERHOUSE INTAKES
1
2
CONE VALVE
CASE: DC81182D20 - DEVIL CANYON OPERATION WITH WATANA IN 2002
- WATANA WEATHER STATION DATA
LEGEND:
PREDICTED TEMPERATURE PROFILES:
1 FEBRUARY 1983
1 MARCH 1983
1 APRIL 1983
ALASKA POWER AUTHORITY
SUSITNA PROJECT
DIVISION MODEL
DEVIL CANYON RESERVOIR
TEMPERATURE PROFILES
HARZA-EBASCO JOINT VENTURE
42-610-04



CASE: ** DC81(82)020 - DEVIL CANYON OPERATION WITH WATANA IN 2002 **
- WATANA WEATHER STATION DATA

LEGEND:
PREDICTED TEMPERATURE PROFILES:
———— 1 MAY 1983
-------- 1 JUNE 1983
—·—·—

ALASKA POWER AUTHORITY	
[illegible]	[illegible]
DEVIL CANYON RESERVOIR TEMPERATURE PROFILES	
HARZA-EBASCO JOINT VENTURE	
[illegible]	[illegible]

Exhibit H-3

CASE C RIVER TEMPERATURE SIMULATIONS

FOR

PROJECTED ENERGY DEMANDS - YEAR 2002

- Temperature Tables, Summer 1981 and 1982
- Middle Susitna River Isotherms (3)

Note: Simulations are based on hydrologic and meteorologic data from the period May 1981 to September 1982.

STREAM TEMPERATURES
WEATHER PERIOD: SUMMER 1981
2002 ENERGY DEMANDS
CASE E-VI FLOW REQUIREMENTS

River Mile	May 31	32	33	34	35	June 36	37	38	39	July 40	41	42	43	44
150	2.1	2.9	3.8	4.2	4.7	5.3	5.9	6.5	6.8	6.7	5.2	4.3	6.2	7.3
140	2.4	3.3	4.2	4.6	5.3	5.6	6.4	7.0	7.2	7.1	5.5	4.6	6.5	7.5
130	2.8	3.8	4.7	5.2	5.9	5.9	6.8	7.5	7.4	7.3	5.8	4.9	6.7	7.7
120	3.1	4.5	5.3	5.9	6.7	6.3	7.4	8.2	7.9	7.8	6.2	5.2	7.0	8.0
110	3.5	5.0	5.9	6.4	7.5	6.7	8.0	8.7	8.3	8.2	6.4	5.5	7.2	8.2
99	3.8	5.6	6.5	7.1	8.2	7.1	8.6	9.4	8.8	8.7	6.8	5.8	7.6	8.5

River Mile	August 45	46	47	48	September 49	50	51	52	October 1	2	3	4	5
150	7.6	7.7	7.3	7.7	8.4	8.4	8.6	8.1	7.4	7.0	6.6	6.2	5.5
140	7.8	7.8	7.4	7.9	8.5	8.4	8.6	7.9	7.1	6.8	6.4	5.9	4.9
130	8.0	7.7	7.5	8.0	8.5	8.4	8.5	7.5	6.6	6.4	5.9	5.5	4.2
120	8.2	7.9	7.7	8.2	8.7	8.4	8.5	7.3	6.3	6.1	5.6	5.2	3.5
110	8.4	8.0	7.8	8.4	8.8	8.5	8.5	7.1	6.0	5.9	5.4	5.0	2.9
99	8.7	8.1	8.0	8.7	9.0	8.5	8.5	6.8	5.6	5.6	5.1	4.6	2.2

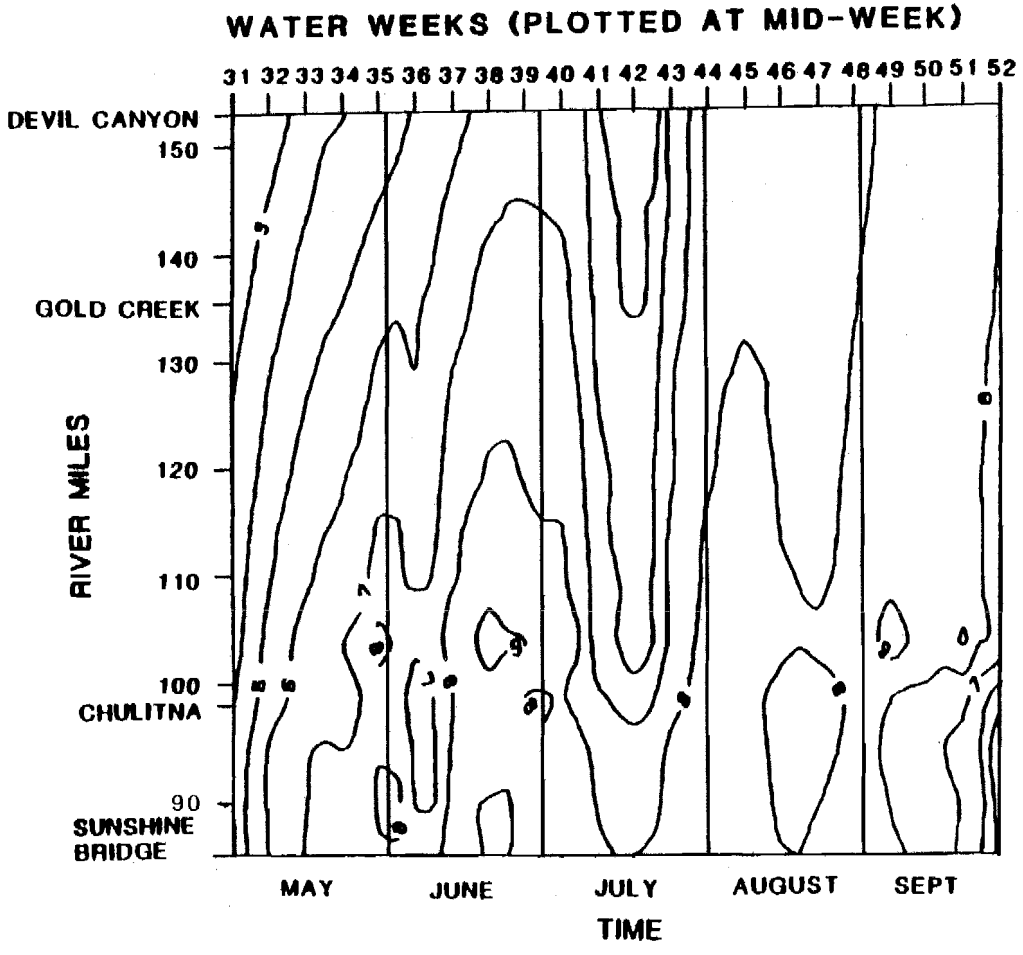
4217911
850214

STREAM TEMPERATURES
WEATHER PERIOD: SUMMER 1982
2002 ENERGY DEMANDS
CASE E-VI FLOW REQUIREMENTS

River Mile	May 31	32	33	34	35	June 36	37	38	39	July 40	41	42	43	44
150	3.6	3.7	4.0	4.3	4.4	4.6	5.1	6.1	6.7	7.0	5.5	5.2	5.4	6.3
140	3.8	3.9	4.2	4.5	4.8	4.9	5.4	6.5	7.3	7.5	5.8	5.5	5.7	6.6
130	4.2	4.1	4.6	4.7	5.2	5.2	5.6	6.8	7.6	7.8	6.2	5.9	6.0	6.9
120	4.6	4.4	5.0	5.2	5.8	5.7	6.0	7.3	8.4	8.4	6.7	6.3	6.3	7.3
110	5.0	4.6	5.4	5.6	6.3	6.1	6.3	7.8	9.0	8.9	7.0	6.7	6.6	7.6
99	5.4	4.9	5.8	6.0	6.8	6.5	6.7	8.4	9.7	9.4	7.5	7.1	7.0	8.0

River Mile	August 45	46	47	48	September 49	50	51	52
150	7.6	7.7	8.0	7.9	7.9	7.9	7.8	8.3
140	7.9	8.0	8.3	8.1	8.0	7.9	7.8	8.2
130	8.2	8.2	8.5	8.2	8.0	7.9	7.7	7.9
120	8.6	8.5	8.9	8.5	8.1	8.0	7.8	7.8
110	8.9	8.8	9.2	8.7	8.3	8.1	7.8	7.8
99	9.1	9.2	9.6	9.0	8.4	8.1	7.9	7.7

4217911
850214



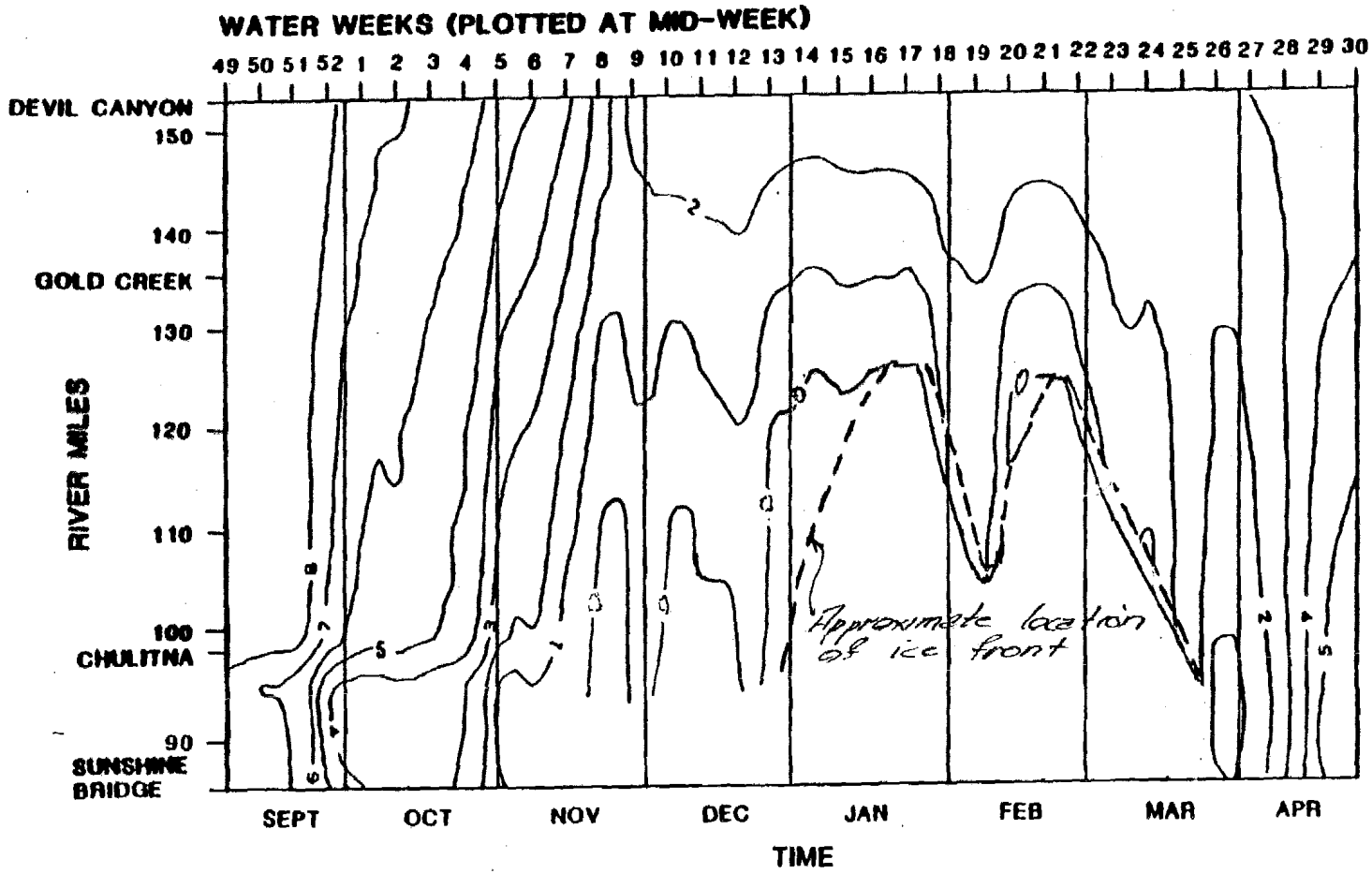
WATANA/DEVIL CANYON OPERATION
2002 ENERGY DEMAND
SUMMER 1981 CLIMATE DATA
CASE E-VI FLOW REQUIREMENTS

ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

MIDDLE SUSITNA RIVER ISOTHERMS

ARCTIC ENVIRONMENTAL INFORMATION AND DATA CENTER

HARZA-EBASCO
SUSITNA JOINT VENTURE



NOTES:

1. TEMPERATURES IN °C

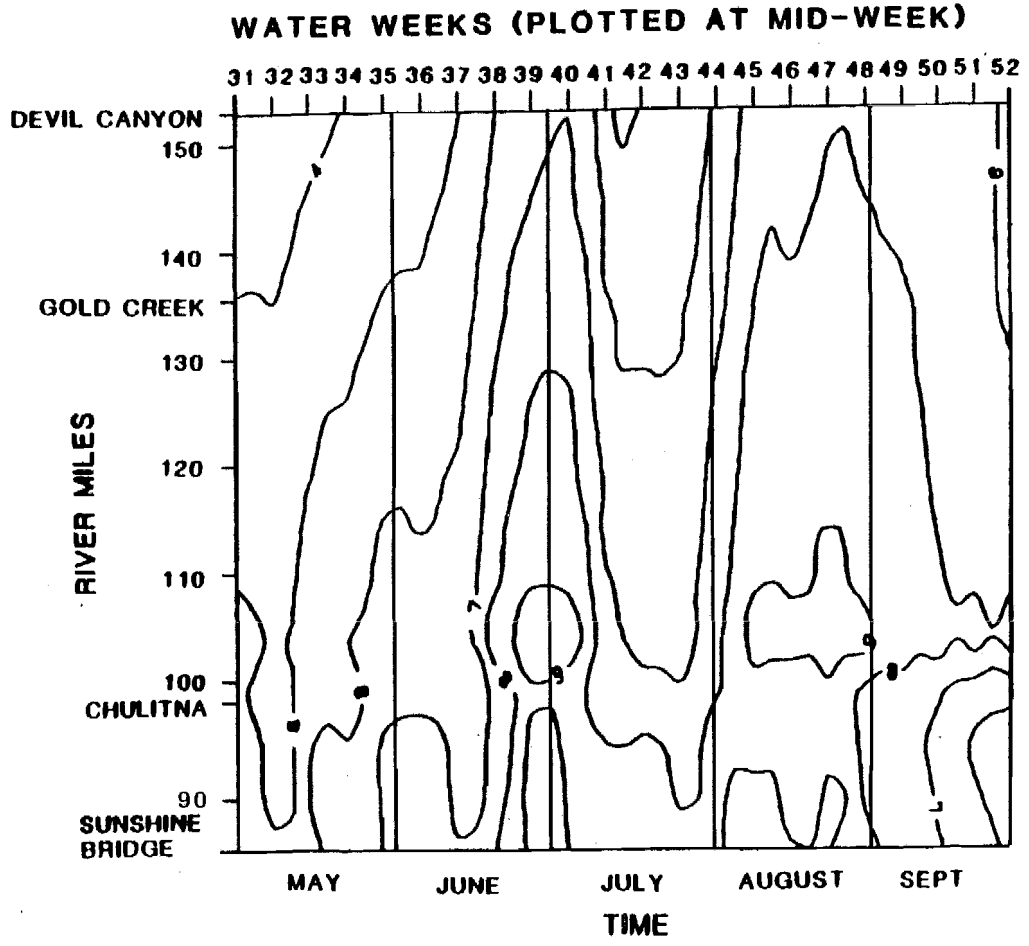
WATANA AND DEVIL CANYON OPERATING
2002 ENERGY DEMAND
WINTER 1981-1982 CLIMATE DATA
CASE E-VI FLOW REQUIREMENTS

ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

MIDDLE SUSITNA RIVER ISOTHERMS

ARCTIC ENVIRONMENTAL INFORMATION AND DATA CENTER

HARZA-EBASCO
SUSITNA JOINT VENTURE



WATANA/DEVIL CANYON OPERATION
2002 ENERGY DEMAND
SUMMER 1982 CLIMATE DATA
CASE E-VI FLOW REQUIREMENTS

ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

MIDDLE SUSITNA RIVER
ISOTHERMS

ARCTIC ENVIRONMENTAL INFORMATION AND DATA CENTER

HARZA-EBASCO
SUSITNA JOINT VENTURE

Exhibit H-4

CASE C RIVER TEMPERATURE SIMULATIONS

FOR

PROJECTED ENERGY DEMANDS - YEAR 2002

- Stream Temperature Tables (2)
- Middle Susitna River Isotherms (3)

Note: 1. Simulations are based on hydrologic and meteorologic data from the period May 1981 to September 1982.

2. Corresponds to Exhibits AI and AJ, Alaska Power Authority 1984b.

STREAM TEMPERATURES
WEATHER PERIOD: SUMMER 1981
ENERGY DEMAND: 2002

WATER WEEK NO.

River	May					June				July				
Mile	31	32	33	34	35	36	37	38	39	40	41	42	43	44
150[1]	2.5	3.2	3.9	4.5	4.9	6.1	7.3	7.9	7.3	7.0	6.1	4.5	5.5	7.1
140	2.7	3.5	4.3	4.9	5.5	6.3	7.8	8.5	7.7	7.4	6.6	4.8	5.8	7.4
130	3.0	4.0	4.7	5.1	6.0	6.5	8.0	8.7	7.8	7.6	6.7	5.1	6.0	7.6
120	3.3	4.6	5.4	6.0	6.8	7.0	8.7	9.5	8.4	8.1	7.2	5.4	6.4	7.9
110	3.6	5.1	5.9	6.5	7.4	7.4	9.3	10.1	8.9	8.5	7.5	5.7	6.6	8.1
99 [2]	4.0	5.6	6.4	7.1	8.1	7.7	9.9	10.8	9.3	9.0	8.0	6.1	7.0	8.4
98 [3]	4.1	5.6	6.2	6.6	7.4	6.6	8.0	8.5	7.8	7.9	7.6	6.8	7.4	8.1
84 [4]	4.5	6.3	7.1	7.3	8.3	7.2	8.8	9.4	8.5	8.6	8.3	7.8	8.3	8.9

WATER WEEK NO.

River	August				September				October				
Mile	45	46	47	48	49	50	51	52	1	2	3	4	5
150[1]	7.4	7.5	7.3	7.6	8.0	8.2	8.3	8.2	7.6	7.2	6.8	6.3	5.6
140	7.6	7.6	7.4	7.8	8.1	8.3	8.4	8.0	7.3	7.0	6.5	5.9	5.1
130	7.8	7.6	7.5	7.9	8.2	8.2	8.2	7.6	6.8	6.5	6.1	5.4	4.4
120	8.0	7.7	7.7	8.1	8.3	8.3	8.3	7.3	6.5	6.3	5.8	5.1	3.7
110	8.2	7.8	7.9	8.3	8.3	8.3	8.3	7.1	6.2	6.1	5.6	4.9	3.2
99 [2]	8.5	8.0	8.1	8.6	8.6	8.4	8.3	6.9	5.8	5.8	5.2	4.5	2.5
98 [3]	8.1	7.4	7.6	7.9	7.7	7.3	6.8	5.0	4.4	4.4	4.1	3.5	1.7
84 [4]	8.8	7.6	8.0	8.6	8.1	7.4	6.8	4.5	3.9	4.0	3.7	3.0	0.9

1/ Downstream of Devil Canyon Dam Site
2/ Upstream of Susitna - Chulitna confluence
3/ Downstream of Susitna - Chulitna confluence (full mixing assumed)
4/ At Sunshine stream gaging station at Parks Highway Bridge

STREAM TEMPERATURES
WEATHER PERIOD: SUMMER 1982
ENERGY DEMAND: 2002

WATER WEEK NO.

River	May					June				July				
Mile	31	32	33	34	35	36	37	38	39	40	41	42	43	44
150[1]	3.7	3.8	4.1	4.3	4.5	4.7	5.3	6.2	6.9	7.9	10.2	6.0	5.1	5.5
140	3.9	4.0	4.3	4.6	4.9	5.0	5.5	6.6	7.5	8.3	10.5	6.4	5.3	5.8
130	4.2	4.2	4.6	4.8	5.2	5.3	5.7	6.8	7.8	8.5	10.2	6.9	5.6	6.2
120	4.6	4.4	5.0	5.2	5.8	5.8	6.1	7.4	8.6	9.1	10.6	7.4	6.0	6.6
110	4.9	4.6	5.4	5.6	6.3	6.2	6.5	7.9	9.2	9.7	11.1	7.9	6.3	7.0
99 [2]	5.3	4.9	5.8	6.0	6.7	6.7	6.9	8.5	9.9	10.2	11.5	8.5	6.7	7.4
98 [3]	5.1	4.6	5.5	5.6	6.4	6.6	6.2	6.8	8.5	8.1	8.4	8.1	7.0	7.6
84 [4]	5.5	4.9	6.1	6.2	7.3	7.7	6.8	7.8	9.7	8.9	9.1	9.1	8.0	8.8

WATER WEEK NO.

River	August				September				October				
Mile	45	46	47	48	49	50	51	52	1	2	3	4	5
150[1]	6.7	7.9	8.5	8.5	8.6	8.6	8.4	8.4	8.3	8.0	7.3	6.3	5.3
140	7.1	8.1	8.8	8.6	8.7	8.6	8.5	8.3	8.1	7.5	6.7	5.4	4.6
130	7.4	8.3	9.0	8.7	8.6	8.5	8.3	8.0	7.6	6.9	5.9	4.3	3.8
120	7.9	8.7	9.3	9.0	8.7	8.6	8.3	7.9	7.4	6.5	5.3	3.3	3.0
110	8.2	9.0	9.6	9.2	8.8	8.7	8.4	7.9	7.2	6.1	4.8	2.5	2.3
99 [2]	8.7	9.3	10.0	9.4	8.9	8.7	8.4	7.7	6.9	5.6	4.1	1.5	1.5
98 [3]	8.1	8.2	8.6	7.6	7.5	7.1	6.3	6.0	4.5	4.1	3.0	1.5	1.4
84 [4]	9.0	8.9	9.3	8.2	7.8	7.2	6.3	5.6	3.8	3.4	2.2	0.8	0.8

[1] Downstream of Devil Canyon Dam Site
[2] Upstream of Susitna - Chulitna confluence
[3] Downstream of Susitna - Chulitna confluence (full mixing assumed)
[4] At Sunshine stream gaging station at Parks Highway Bridge

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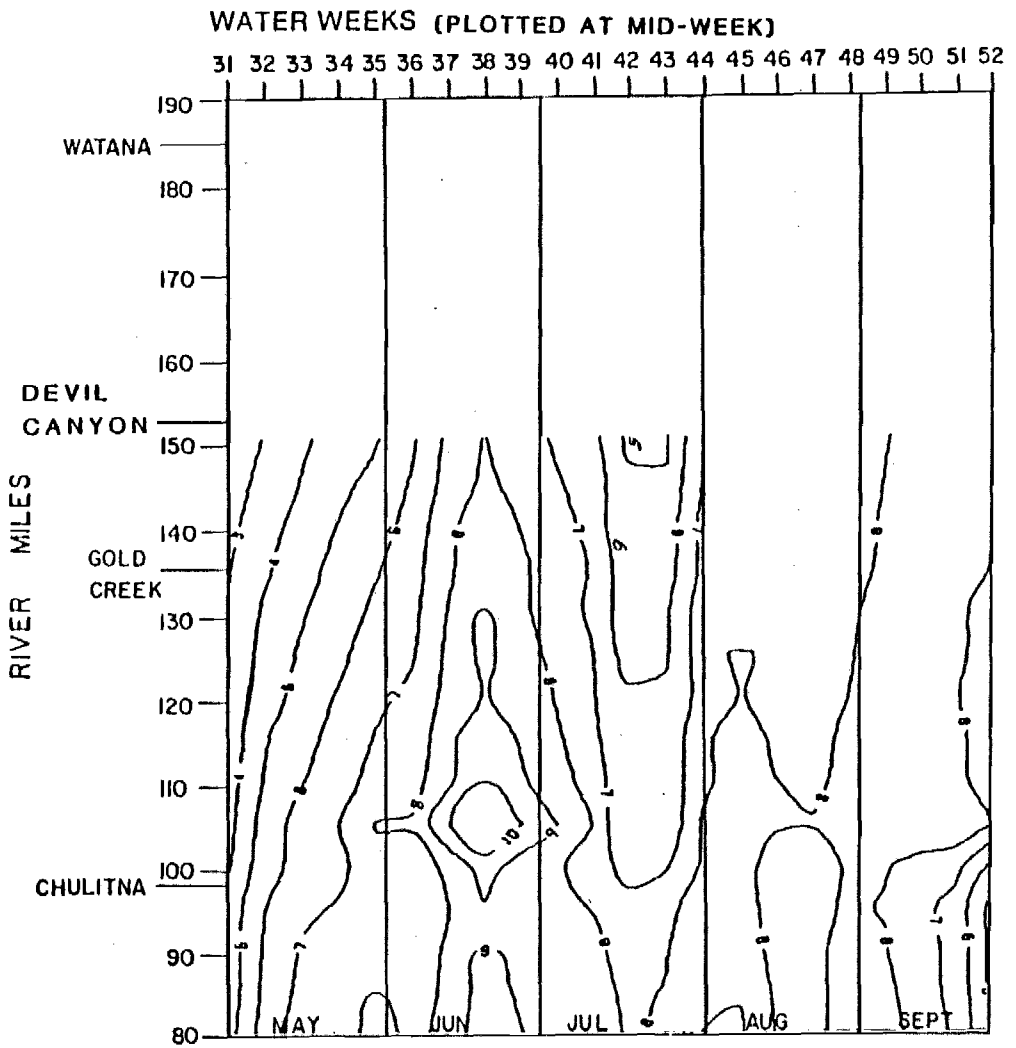
MIDDLE SUSITNA RIVER - ISOTHERMS



TIME

NOTES :

1. TEMPERATURES IN °C.

WATANA/DEVIL CANYON, 2002 ENERGY DEMAND

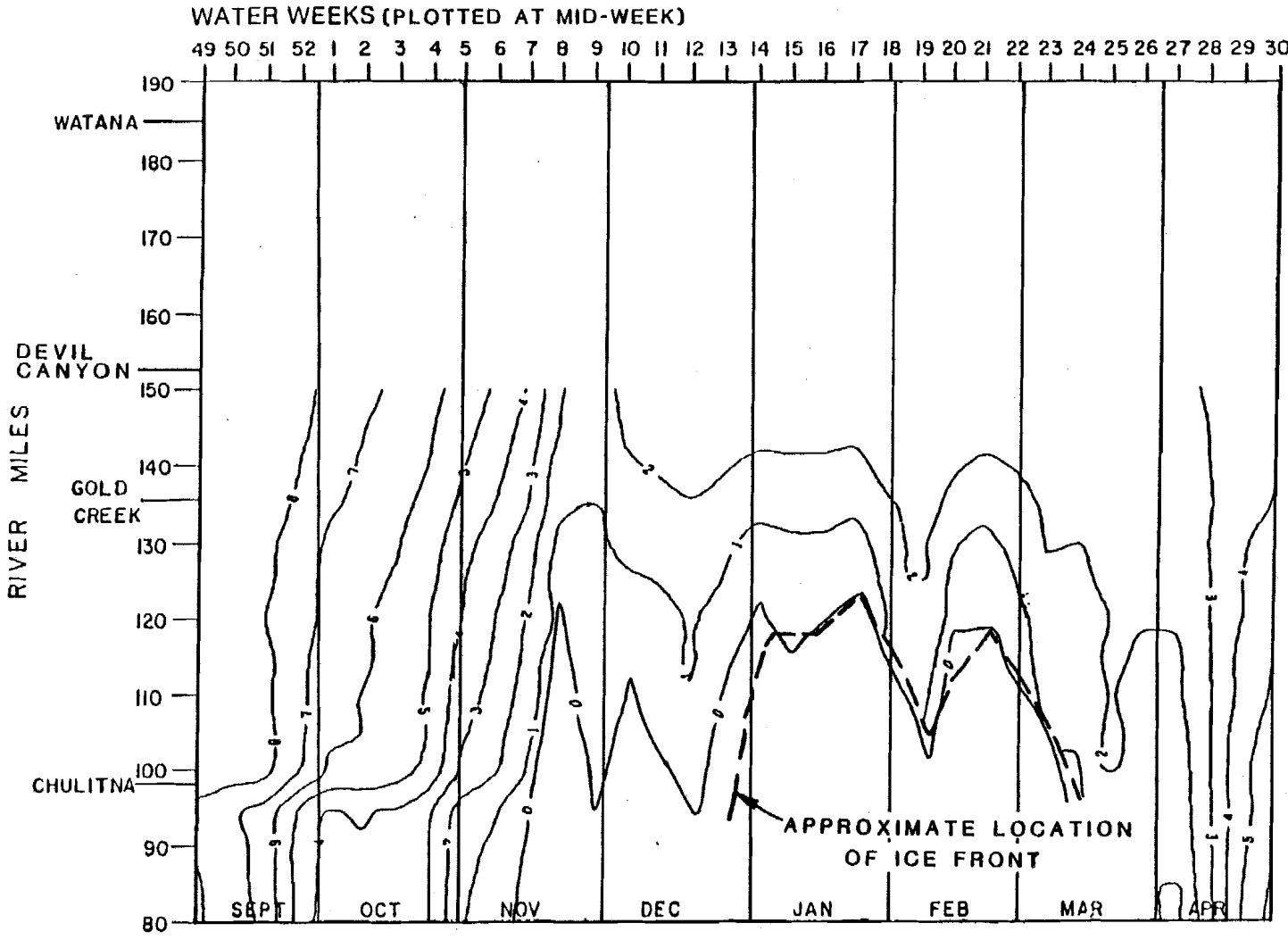
SUMMER 1981 CLIMATE DATA

ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

ARCTIC ENVIRONMENTAL INFORMATION AND DATA CENTER

HARZA-EBASCO
SUSITNA JOINT VENTURE

MIDDLE SUSITNA RIVER-ISOTHERMS



NOTES :

1. TEMPERATURES IN °C.
2. APPROXIMATE LOCATION OF ICE FRONT FROM RIVER ICE SIMULATION PLOTS.

TIME

WATANA/DEVIL CANYON, 2002 ENERGY DEMAND

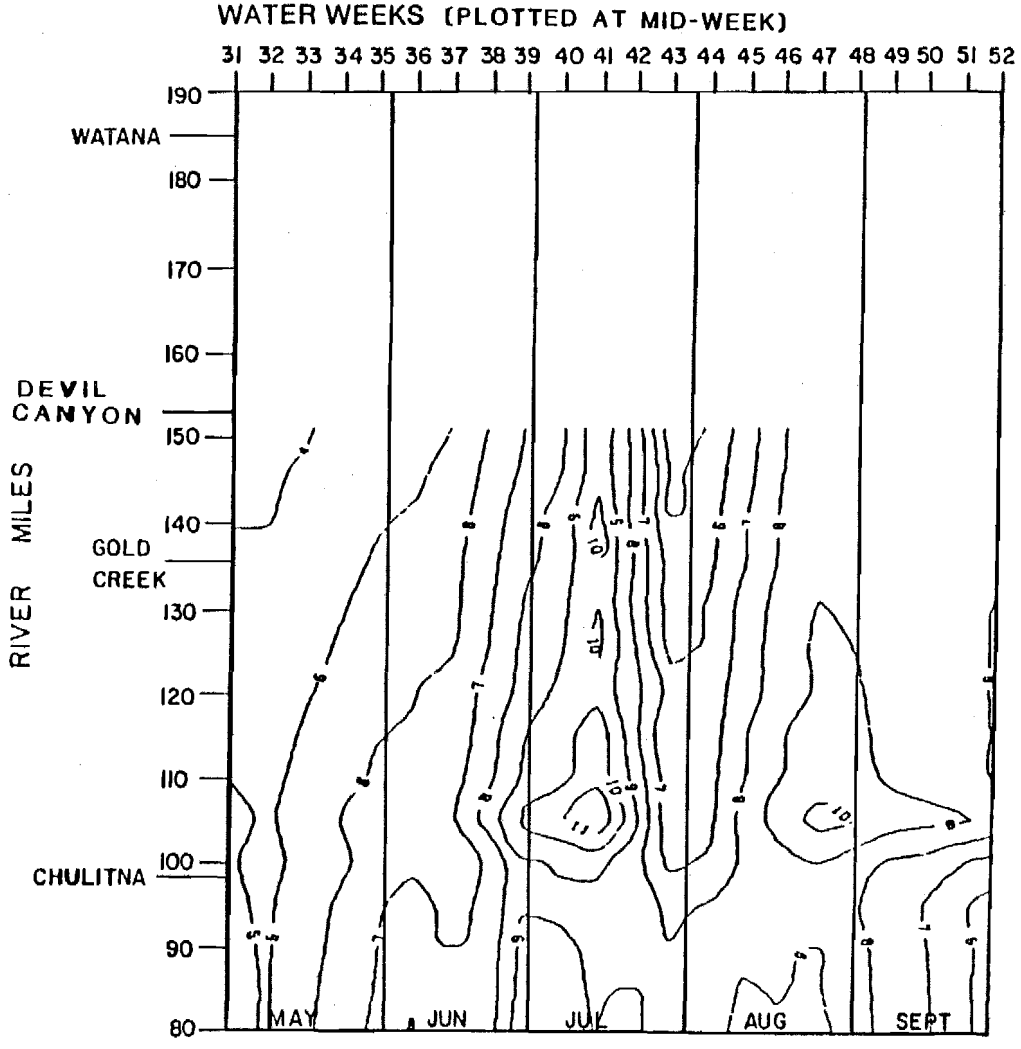
WINTER 1981-1982 CLIMATE DATA

ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

ARCTIC ENVIRONMENTAL INFORMATION AND DATA CENTER

HARZA-EBASCO
SUSITNA JOINT VENTURE

MIDDLE SUSITNA RIVER - ISOTHERMS



TIME

WATANA/DEVIL CANYON, 2002 ENERGY DEMAND

SUMMER 1982 CLIMATE DATA

NOTES :

1. TEMPERATURES IN °C.

ALASKA POWER AUTHORITY
SUSITNA HYDROELECTRIC PROJECT

ARCTIC ENVIRONMENTAL INFORMATION AND DATA CENTER

HARZA-EBASCO
SUSITNA JOINT VENTURE

Exhibit H-5

A COMPARISON OF SIMULATED RIVER TEMPERATURES

AT RIVER MILES 100, 130, and 150

FOR

CASE C AND CASE E-VI FLOW REQUIREMENTS

—

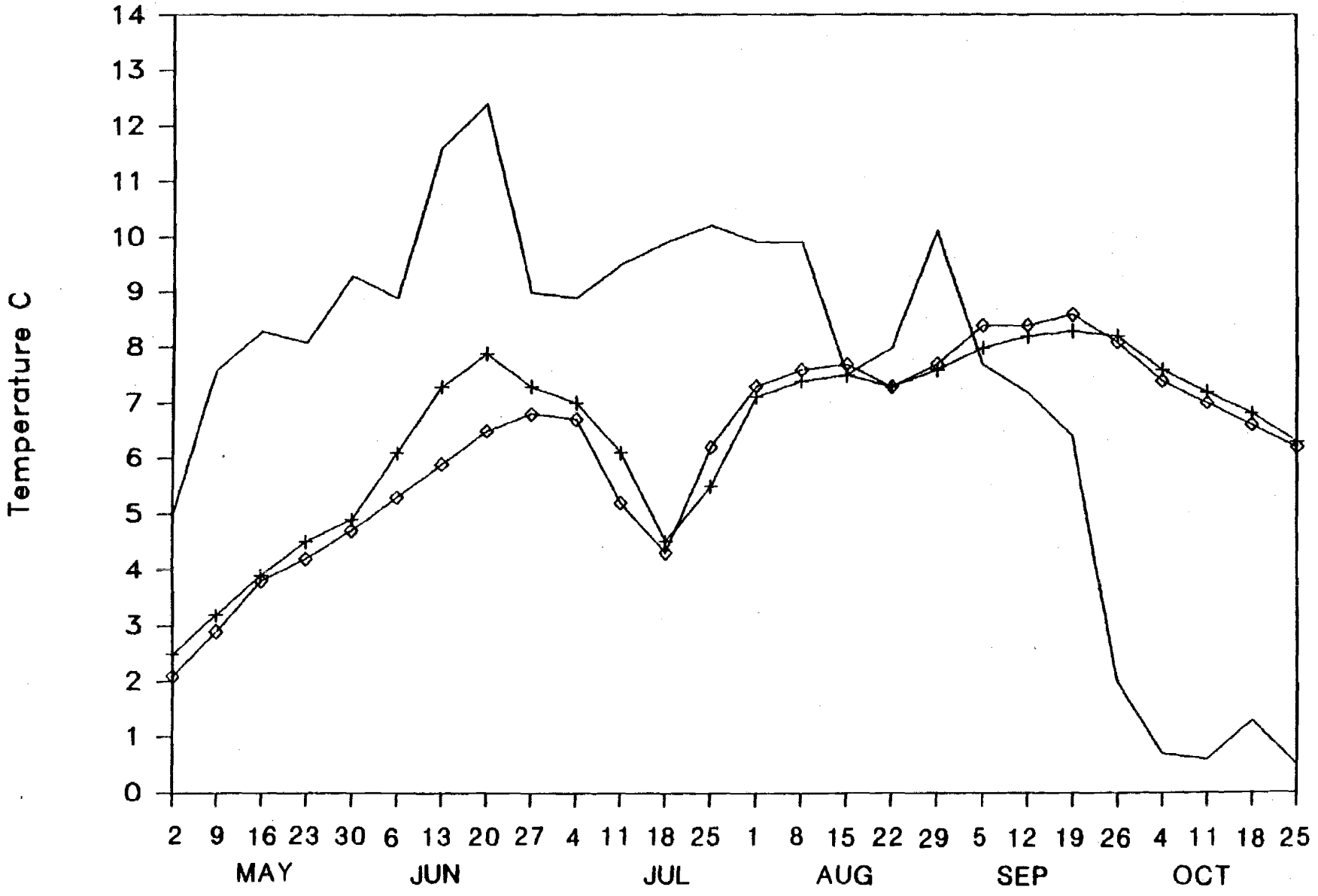
PROJECTED ENERGY DEMANDS FOR YEAR 2002

—

Note: Simulations are based on hydrologic and meteorologic data from the period May 1981 to September 1982.

SUSITNA RIVER TEMPERATURES

1981 RM 150



SIMULATED TEMPERATURES
AT RIVER MILE 150
1981 WEATHER
2002 ENERGY DEMANDS

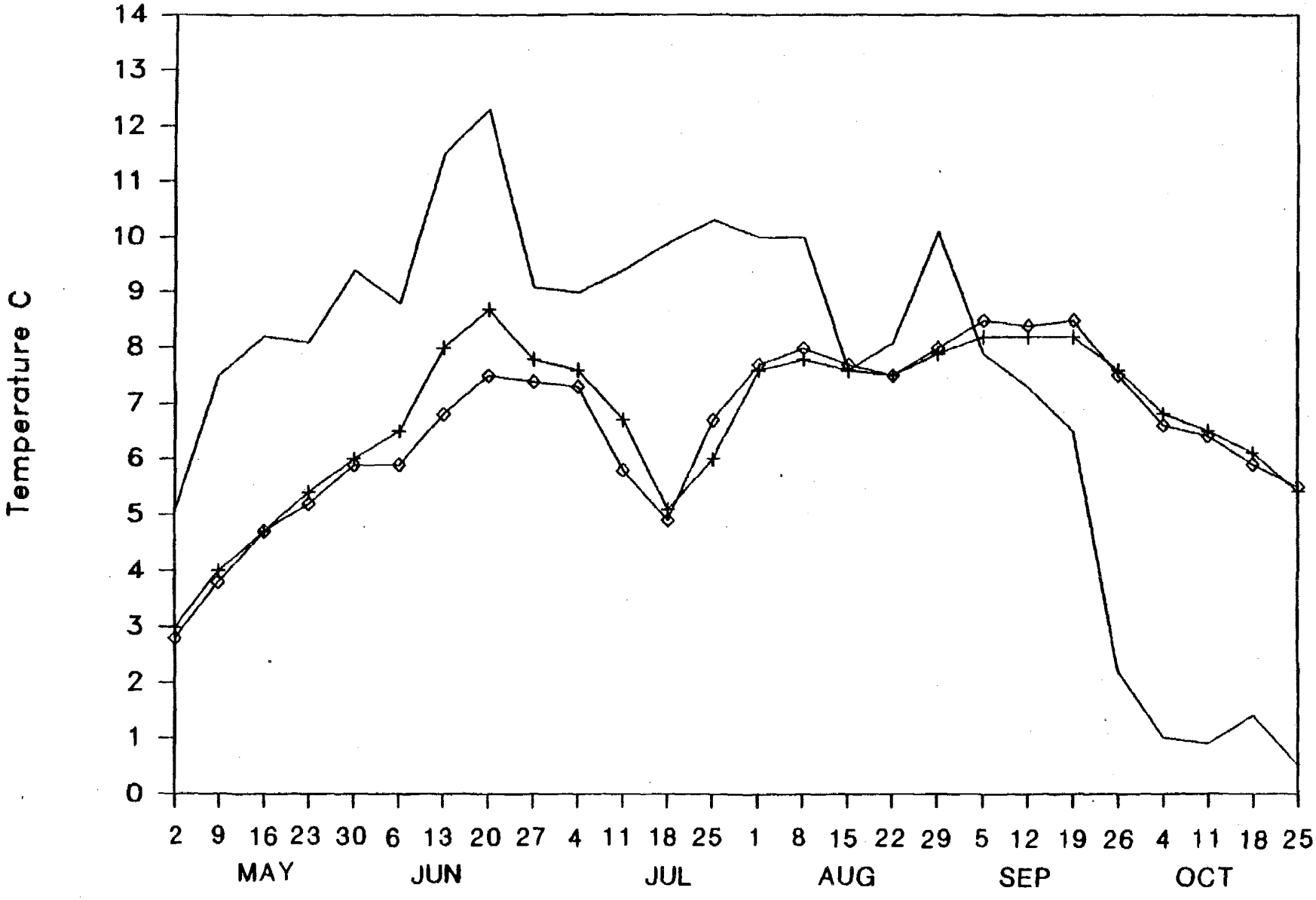
——— NATURAL CONDITIONS
x CASE C FLOW REQUIREMENTS
◇ CASE E-VI FLOW REQUIREMENTS

HARZA-EBASCO SUSITNA JOINT VENTURE

ALASKA POWER AUTHORITY

SUSITNA RIVER TEMPERATURES

1981 RM 130



SIMULATED TEMPERATURES
AT RIVER MILE 130
1981 WEATHER
2002 ENERGY DEMANDS

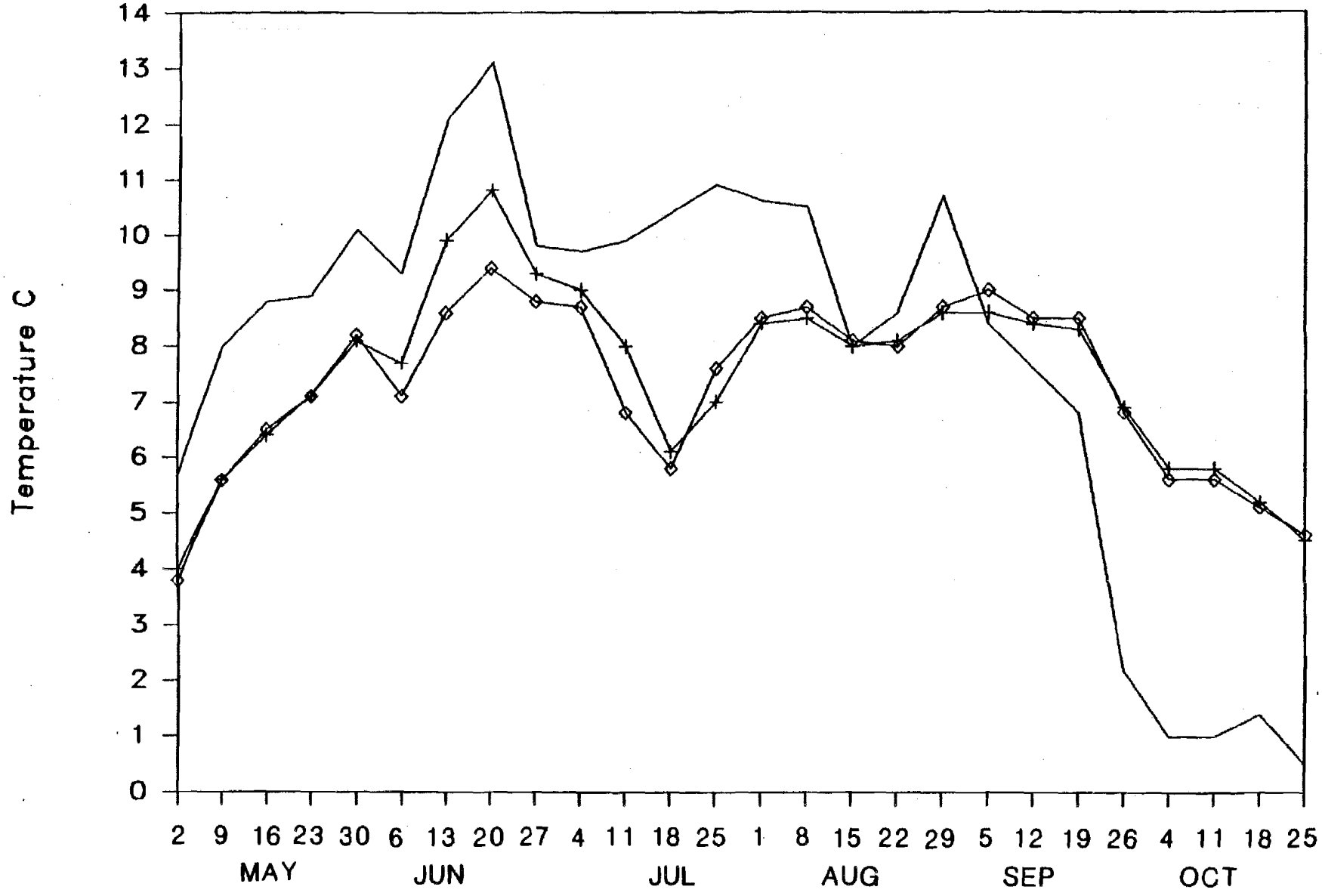
——— NATURAL CONDITIONS
x CASE C FLOW REQUIREMENTS
◇ CASE E-VI FLOW REQUIREMENTS

HARZA-EBASCO SUSITNA JOINT VENTURE

ALASKA POWER AUTHORITY

SUSITNA RIVER TEMPERATURES

1981 RM 100



SIMULATED TEMPERATURES
AT RIVER MILE 100
1981 WEATHER
2002 ENERGY DEMANDS

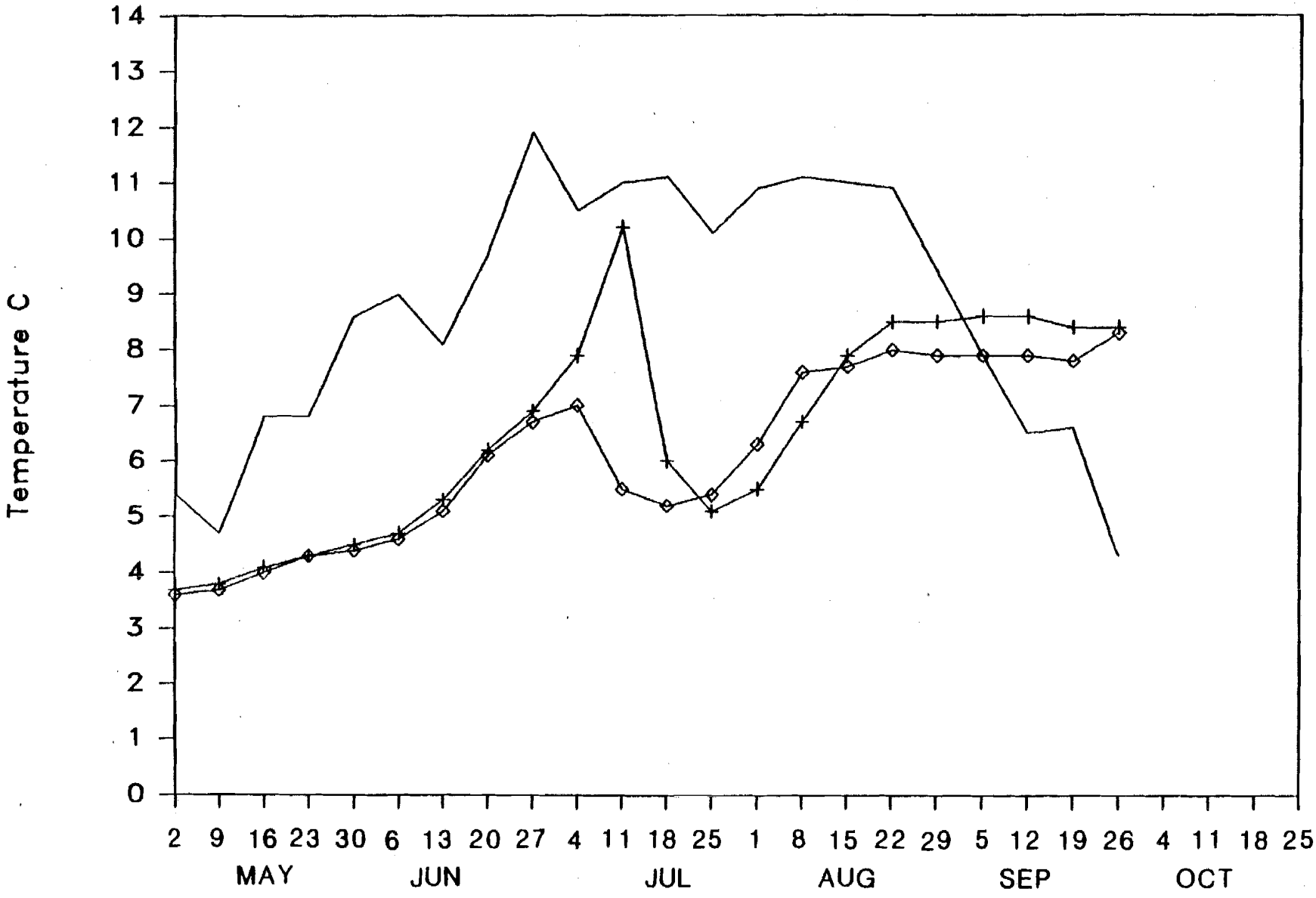
——— NATURAL CONDITIONS
x CASE C FLOW REQUIREMENTS
◇ CASE E-VI FLOW REQUIREMENTS

HARZA-EBASCO SUSITNA JOINT VENTURE

ALASKA POWER AUTHORITY

SUSITNA RIVER TEMPERATURES

1982 RM 150



SIMULATED TEMPERATURES
AT RIVER MILE 150
1982 WEATHER
2002 ENERGY DEMANDS

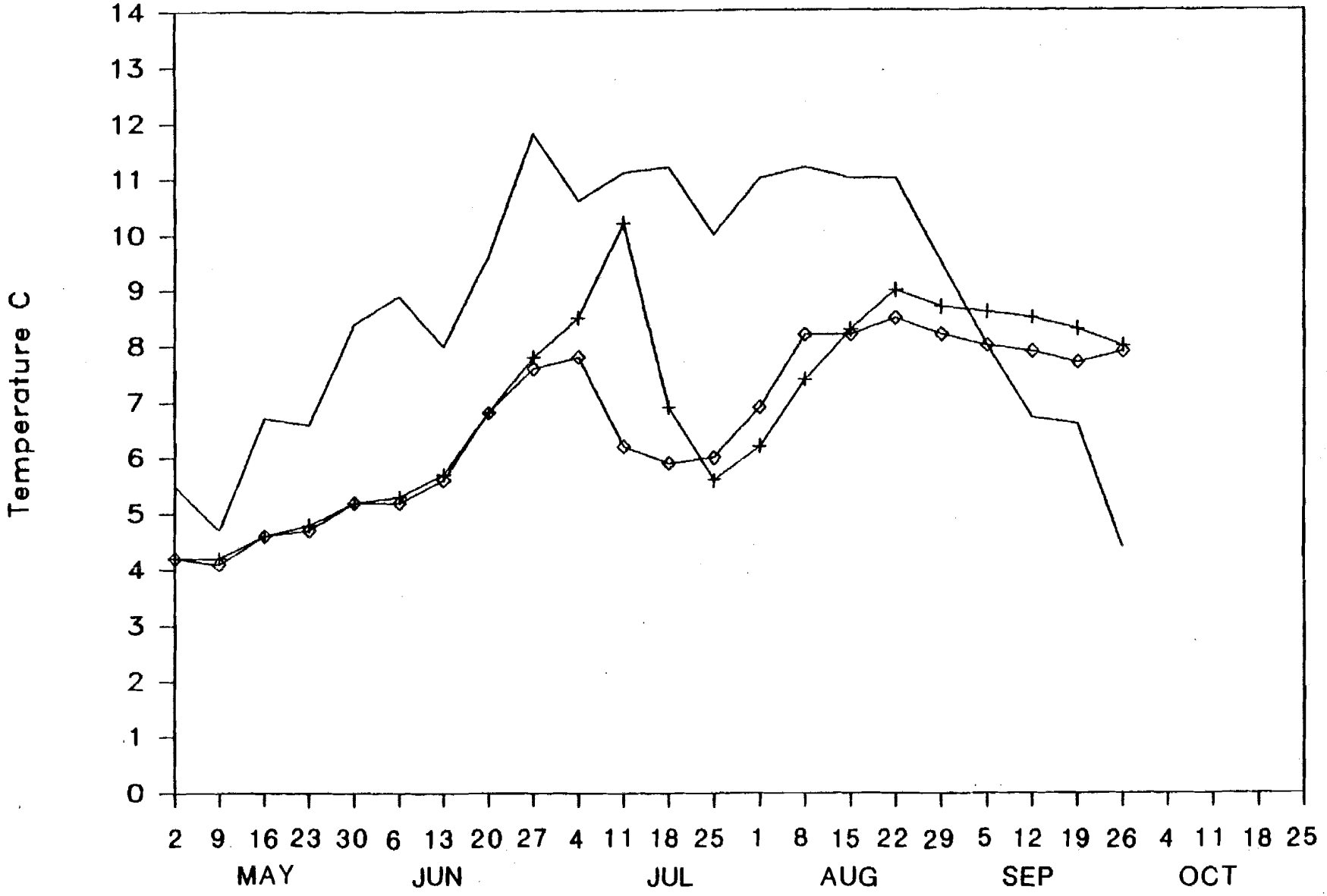
——— NATURAL CONDITIONS
x CASE C FLOW REQUIREMENTS
◇ CASE E-VI FLOW REQUIREMENTS

HARZA-EBASCO SUSITNA JOINT VENTURE

ALASKA POWER AUTHORITY

SUSITNA RIVER TEMPERATURES

1982 RM 130



SIMULATED TEMPERATURES
AT RIVER MILE 130
1982 WEATHER
2002 ENERGY DEMANDS

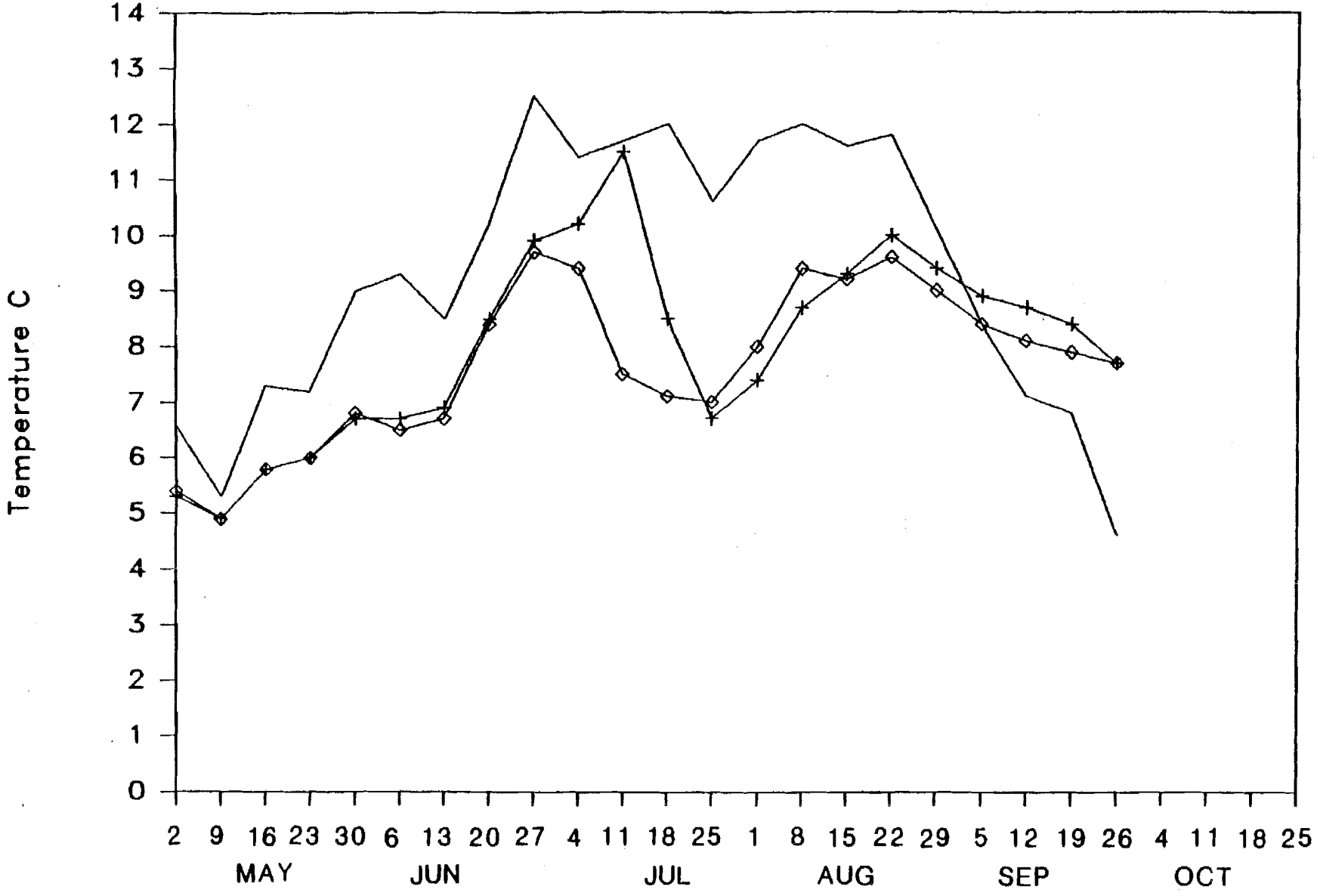
——— NATURAL CONDITIONS
x CASE C FLOW REQUIREMENTS
◇ CASE E-VI FLOW REQUIREMENTS

HARZA-EBASCO SUSITNA JOINT VENTURE

ALASKA POWER AUTHORITY

SUSITNA RIVER TEMPERATURES

1982 RM 100



SIMULATED TEMPERATURES
AT RIVER MILE 100
1982 WEATHER
2002 ENERGY DEMANDS

——— NATURAL CONDITIONS
x CASE C FLOW REQUIREMENTS
◇ CASE E-VI FLOW REQUIREMENTS

HARZA-EBASCO SUSITNA JOINT VENTURE

ALASKA POWER AUTHORITY

Exhibit H-6

CASE E-VI RIVER ICE SIMULATIONS

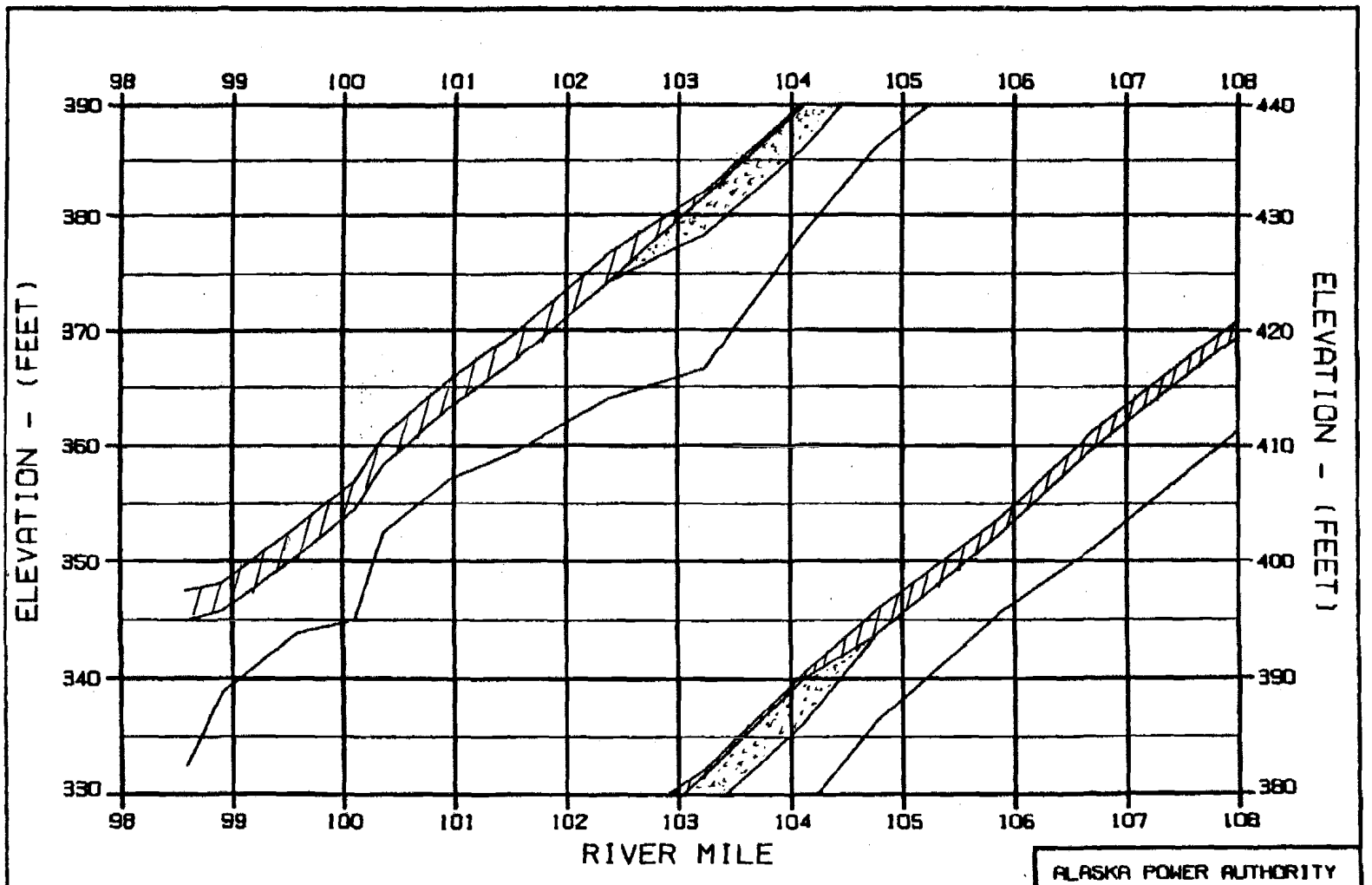
FOR

PROJECTED ENERGY DEMANDS - YEAR 2002

- Profiles of Maximum Stages (5 sheets)
- Progression of Ice Front and Zero Degree Isotherm (1 sheet)
- Time History (22 locations)

Note: Simulations are based on hydrologic and meterologic data from the period November 1981 to May 1982.

c



LEGEND:

TOP OF SOLID ICE
SLUSH/SOLID ICE INTERFACE
BOTTOM OF SLUSH ICE
RIVER BED

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE E-6-02 TEMP: INFLOW-MATCHING
EXISTING WATANA INTAKE DESIGN
REFERENCE RUN NO. : 8102EN8

ALASKA POWER AUTHORITY

SUSITNA PROJECT

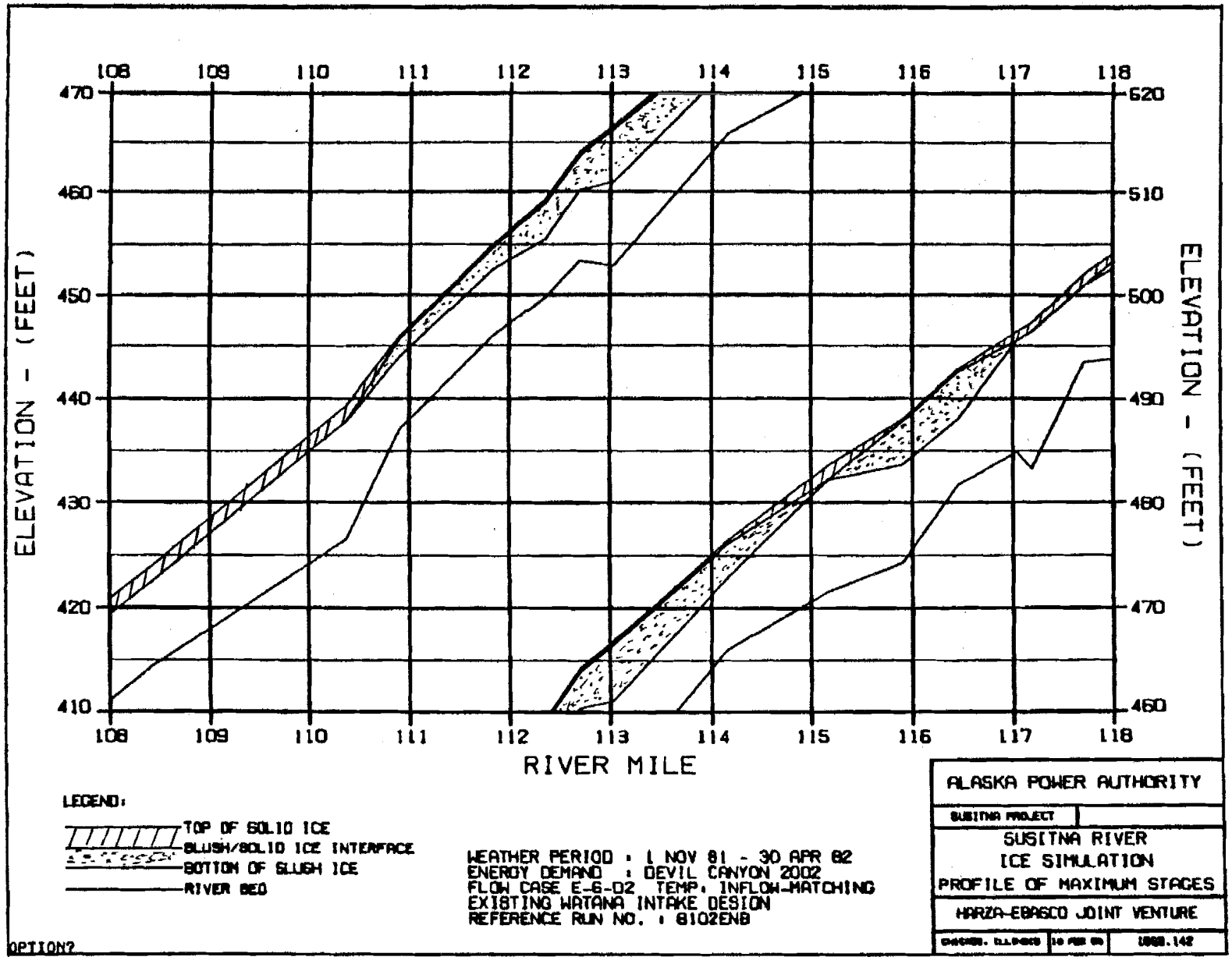
SUSITNA RIVER
ICE SIMULATION
PROFILE OF MAXIMUM STAGES

HARZA-EBASCO JOINT VENTURE

1588.142

OPTION?

C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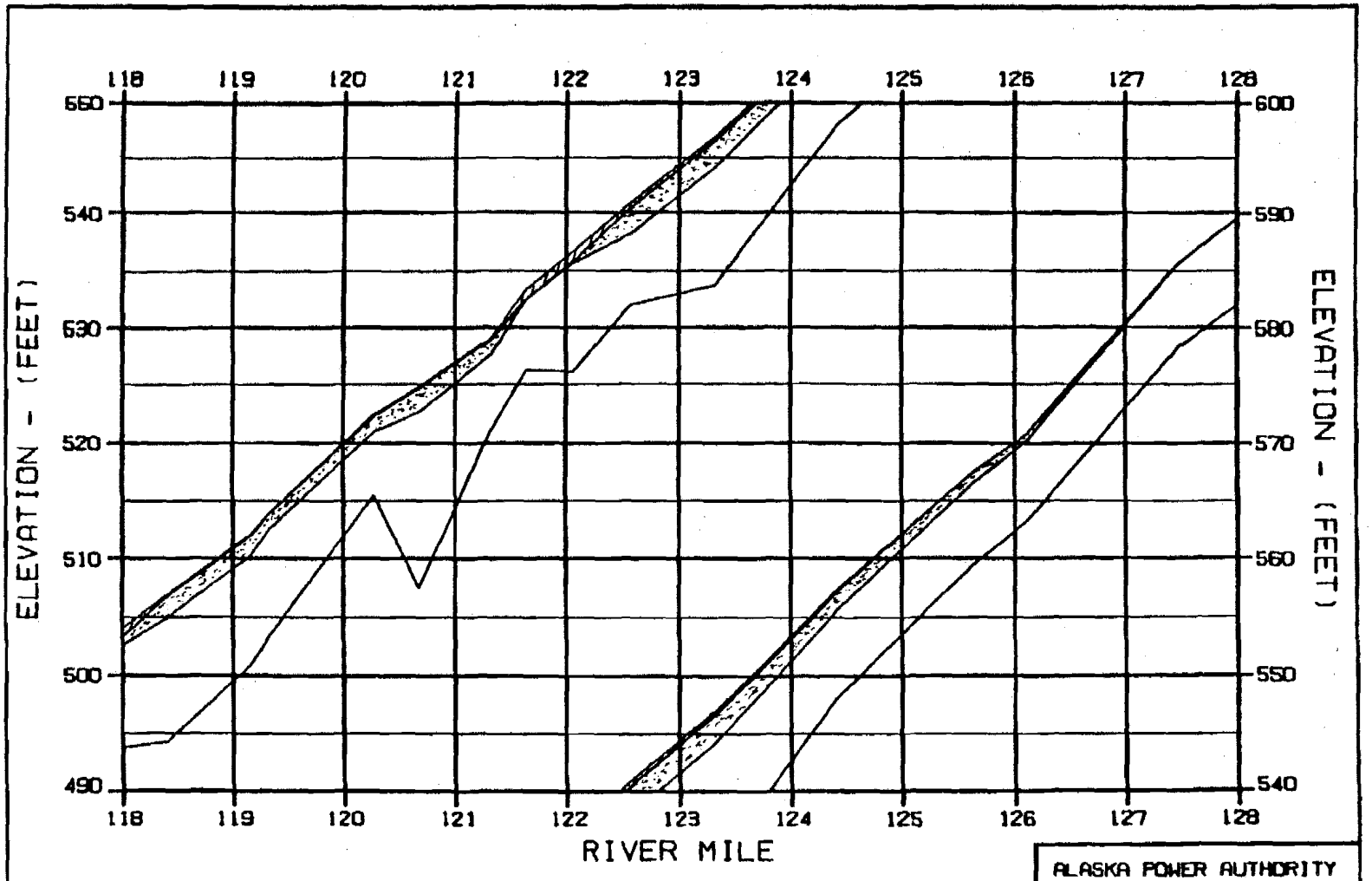
118
470
460
450
440
430
420
410
620
510
500
490
480
470
460
ELEVATION - (FEET)
ELEVATION - (FEET)
RIVER MILE
LEGEND:
TOP OF SOLID ICE
SLUSH/SOLID ICE INTERFACE
BOTTOM OF SLUSH ICE
RIVER BED
WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE E-6-02 TEMP. INFLOW-MATCHING
EXISTING WATANA INTAKE DESIGN
REFERENCE RUN NO. : 8102ENB
ALASKA POWER AUTHORITY
SUSITNA PROJECT
SUSITNA RIVER
ICE SIMULATION
PROFILE OF MAXIMUM STAGES
HARZA-EBASCO JOINT VENTURE
OPTION2

C



LEGEND:

TOP OF SOLID ICE
SLUSH/SOLID ICE INTERFACE
BOTTOM OF SLUSH ICE
RIVER BED

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE E-6-02 TEMP. INFLOW-MATCHING
EXISTING WATANA INTAKE DESIGN
REFERENCE RUN NO. : 8102ENB

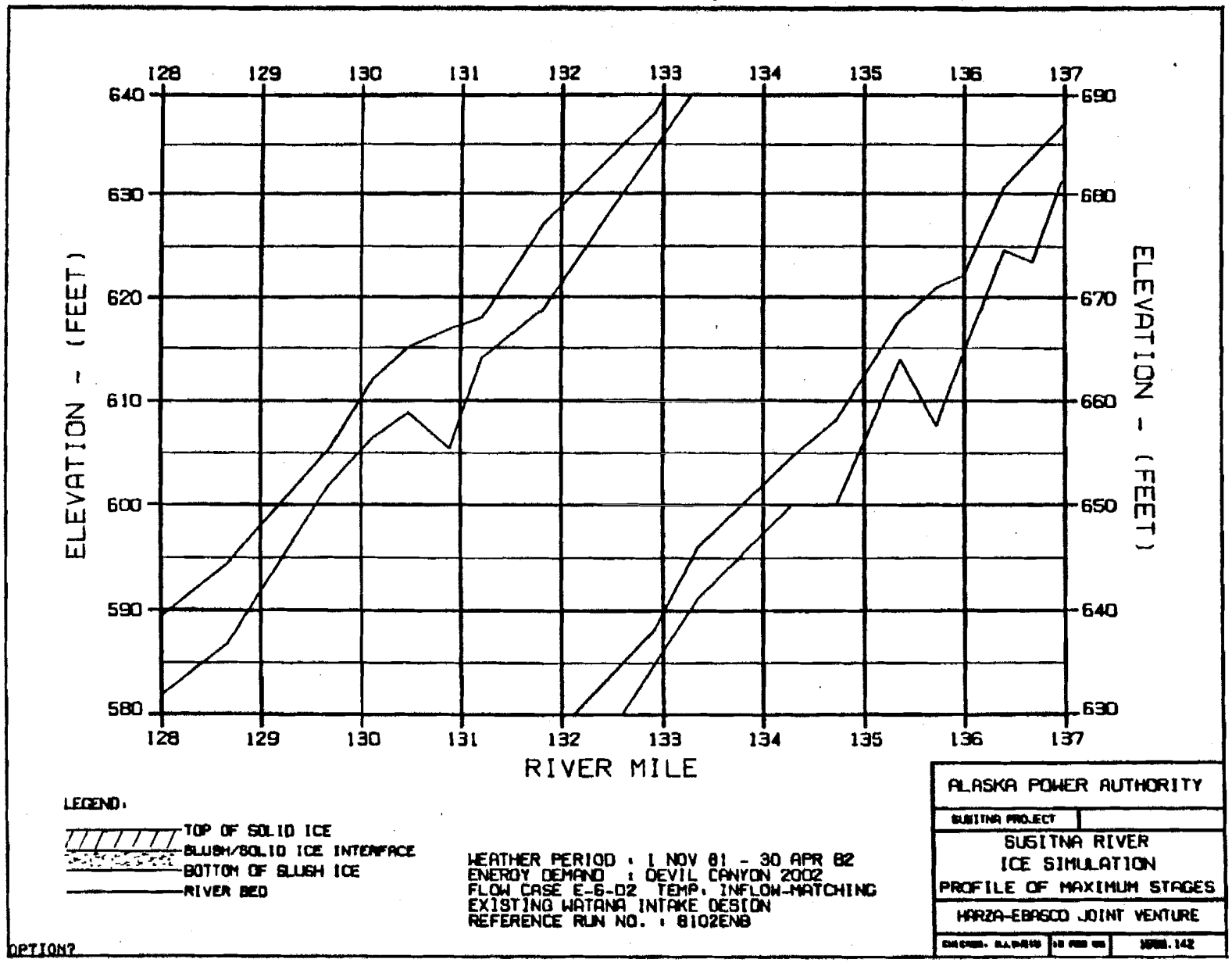
ALASKA POWER AUTHORITY

SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
PROFILE OF MAXIMUM STAGES

HARZA-EBASCO JOINT VENTURE

OPTION?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580
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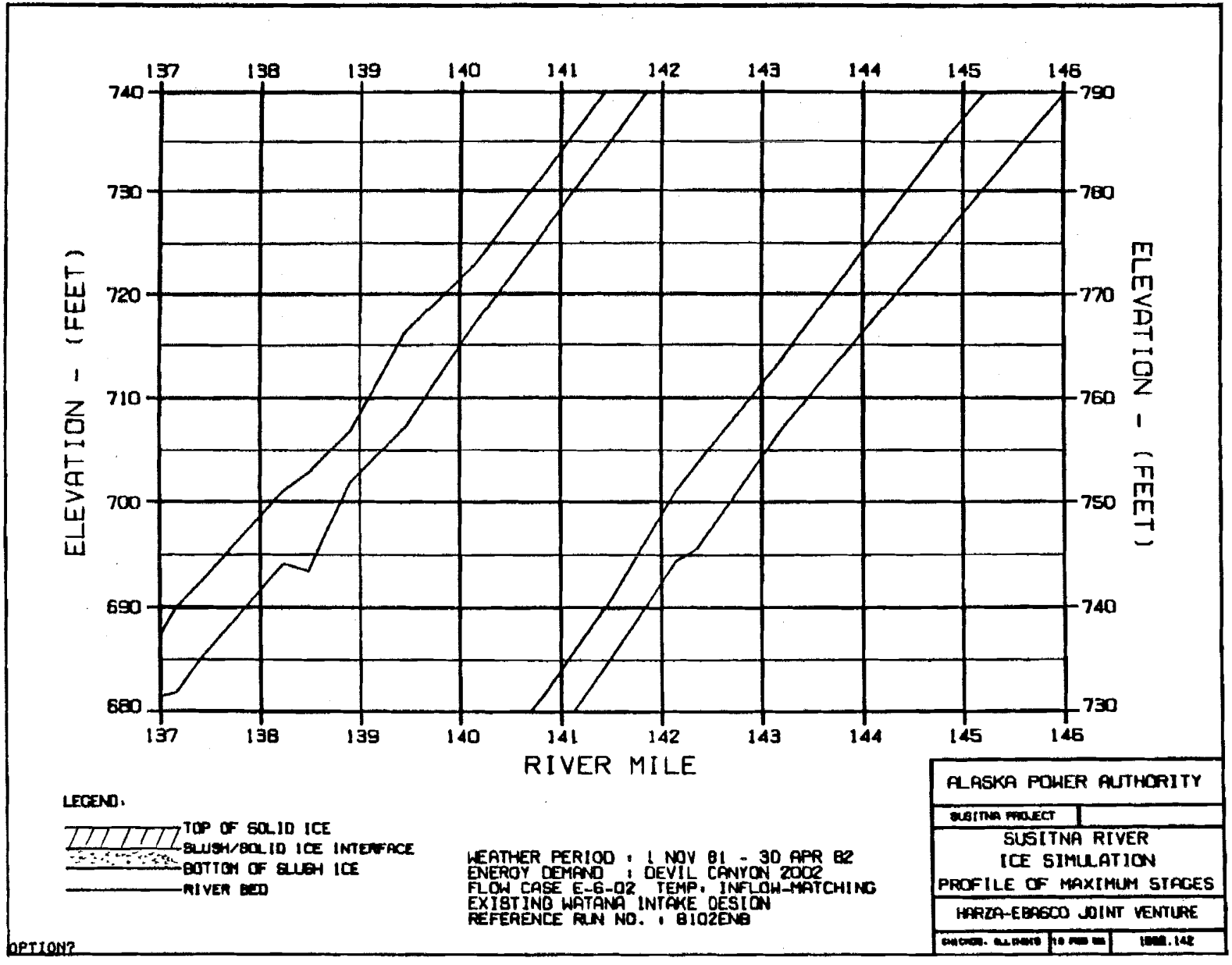
660
650
640
630
ELEVATION - (FEET)
ELEVATION - (FEET)
RIVER MILE
LEGEND:
TOP OF SOLID ICE
SLUSH/SOLID ICE INTERFACE
BOTTOM OF SLUSH ICE
RIVER BED
WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE E-6-02 TEMP. INFLOW-MATCHING
EXISTING WATANA INTAKE DESIGN
REFERENCE RUN NO. : 8102ENB
ALASKA POWER AUTHORITY
SUSITNA PROJECT
SUSITNA RIVER
ICE SIMULATION
PROFILE OF MAXIMUM STAGES
HARZA-EBASCO JOINT VENTURE
OPTION?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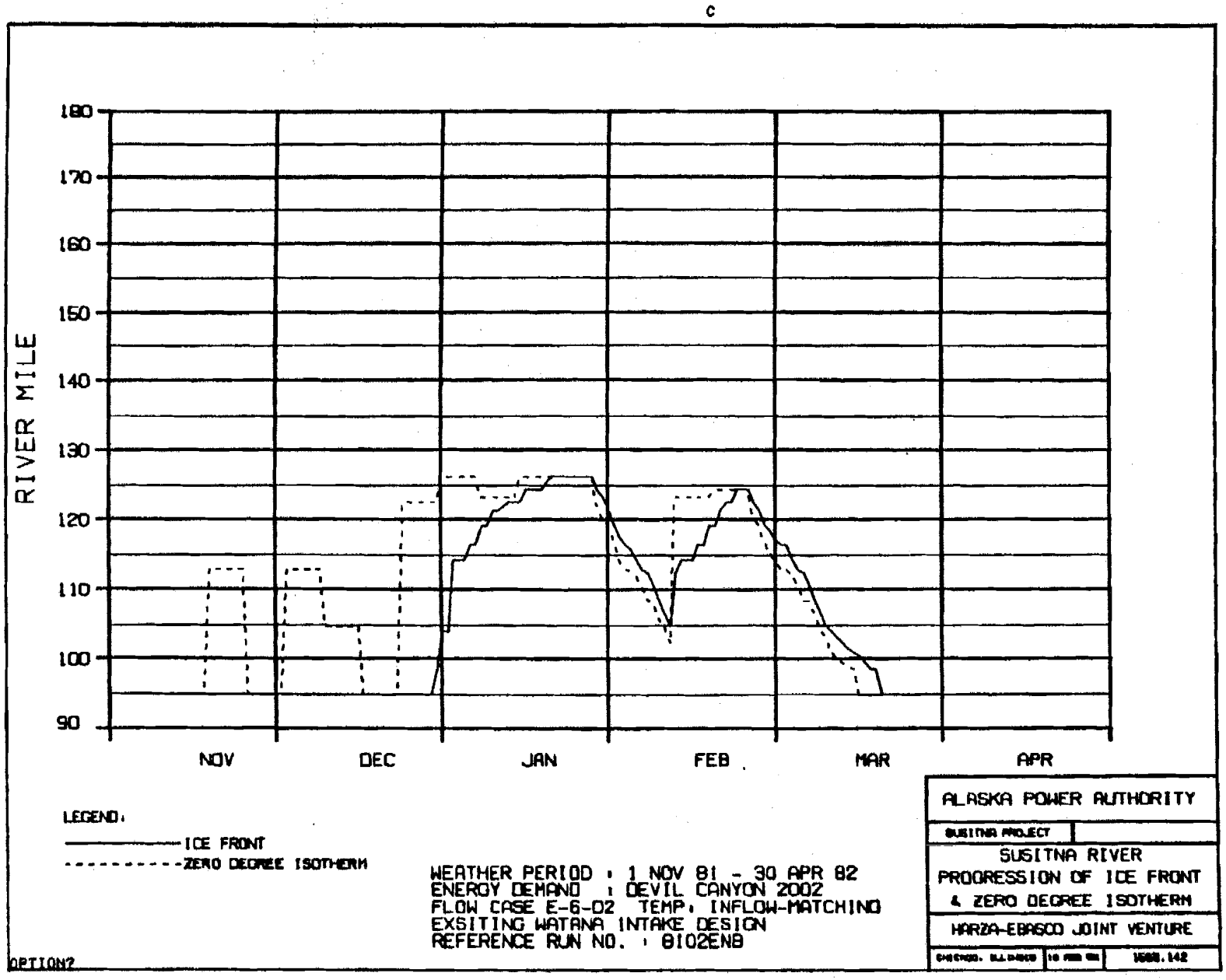
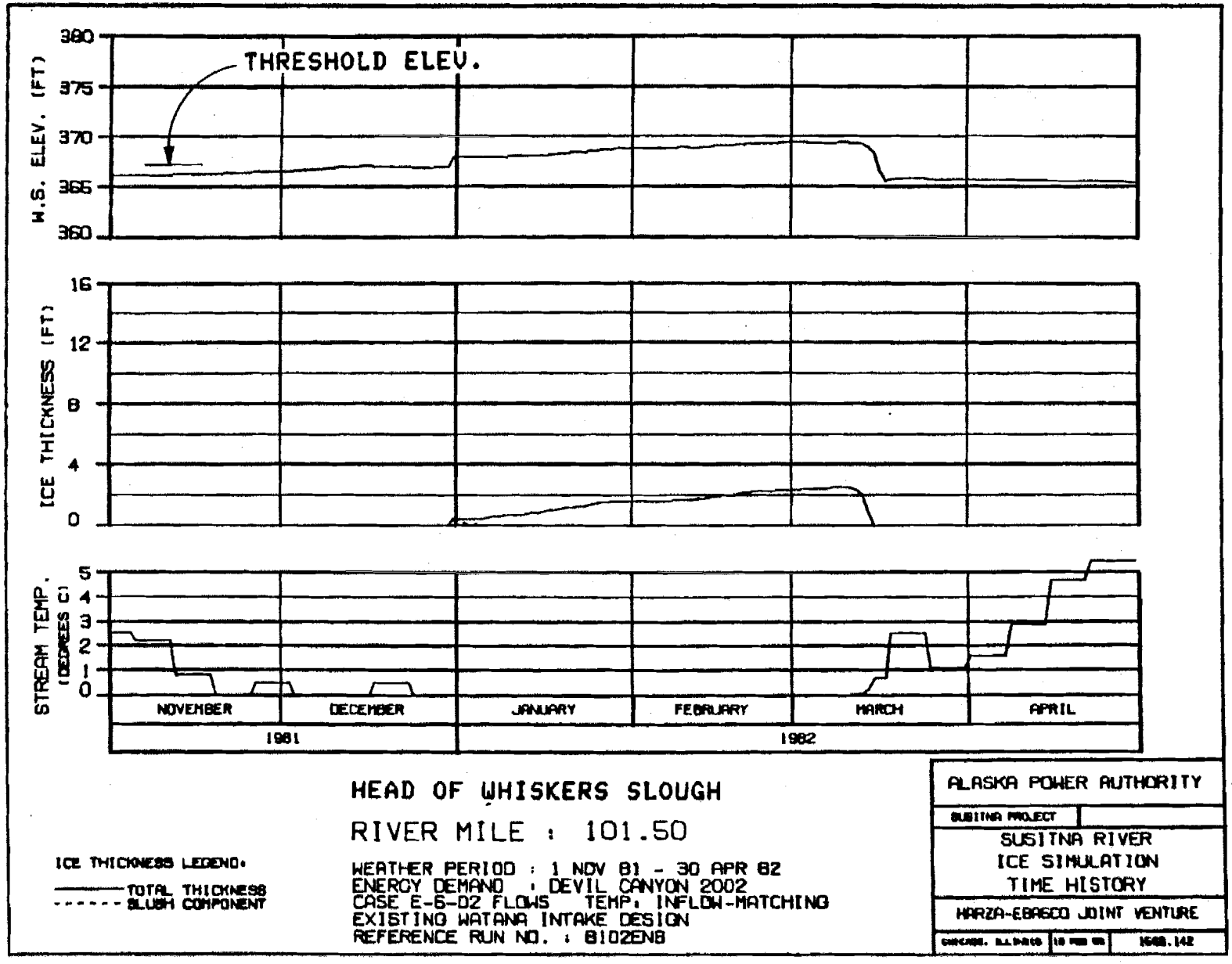
750
740
730
ELEVATION - (FEET)
ELEVATION - (FEET)
RIVER MILE
LEGEND:
TOP OF SOLID ICE
SLUSH/SOLID ICE INTERFACE
BOTTOM OF SLUSH ICE
RIVER BED
WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE E-6-02 TEMP. INFLOW-MATCHING
EXISTING WATANA INTAKE DESIGN
REFERENCE RUN NO. : B102EN8
ALASKA POWER AUTHORITY
SUSITNA PROJECT
SUSITNA RIVER
ICE SIMULATION
PROFILE OF MAXIMUM STAGES
HARZA-EBASCO JOINT VENTURE
OPTION?


c
180
170
160
150
140
130
120
110
100
90
RIVER MILE
NOV
DEC
JAN
FEB
MAR
APR
LEGEND:
ICE FRONT
ZERO DEGREE ISOTHERM
WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE E-6-02 TEMP: INFLOW-MATCHING
EXSITING WATANA INTAKE DESIGN
REFERENCE RUN NO. : 8102ENB
OPTION2
ALASKA POWER AUTHORITY
SUSITNA PROJECT
SUSITNA RIVER
PROGRESSION OF ICE FRONT
& ZERO DEGREE ISOTHERM
HARZA-EBASCO JOINT VENTURE



HEAD OF WHISKERS SLOUGH

RIVER MILE : 101.50

ICE THICKNESS LEGEND:

——— TOTAL THICKNESS

- - - - - - SLUSH COMPONENT

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
CASE E-6-D2 FLOWS TEMP: INFLOW-MATCHING
EXISTING WATANA INTAKE DESIGN
REFERENCE RUN NO. : B102EN8

ALASKA POWER AUTHORITY

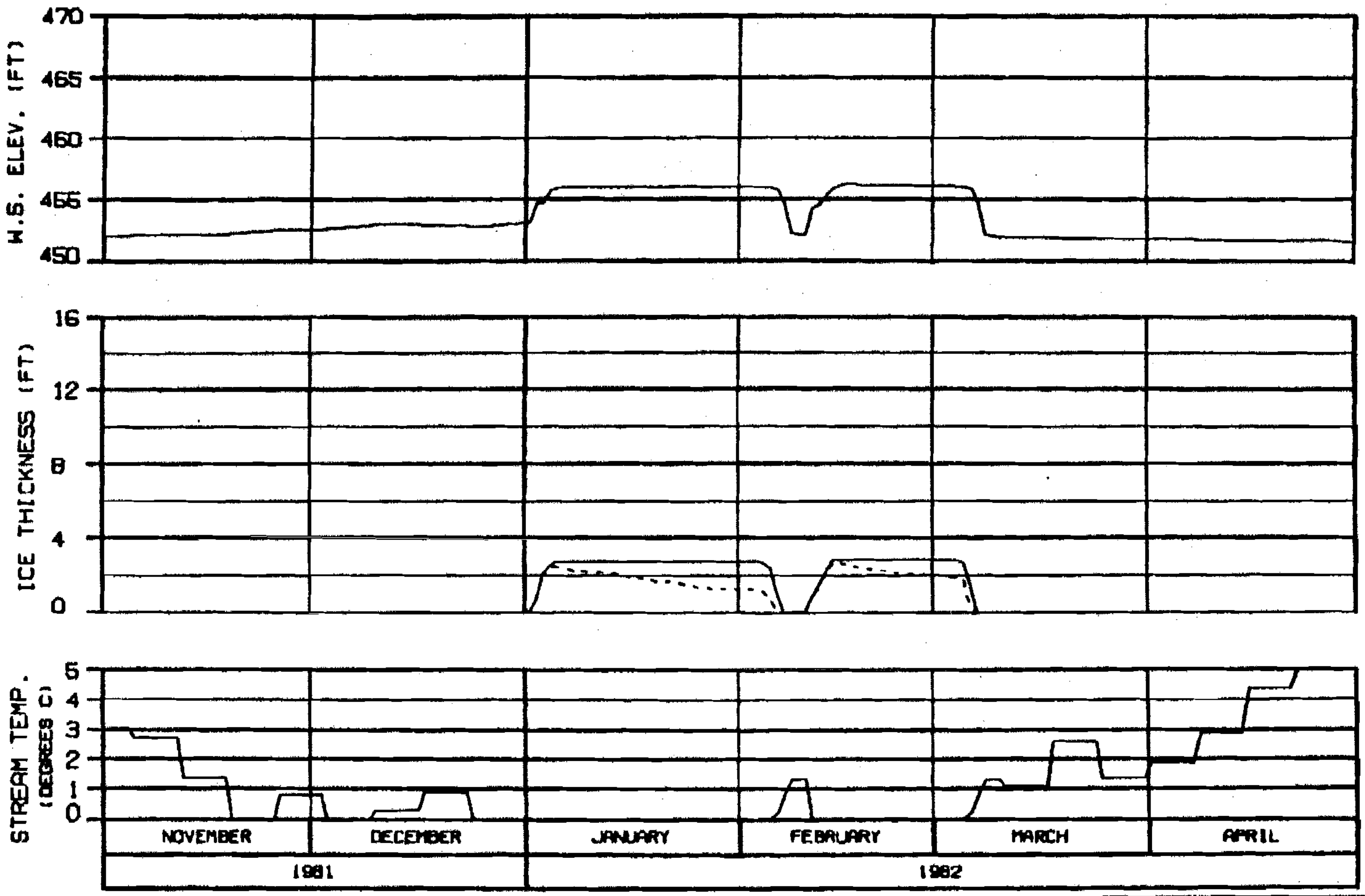
SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE

CHICAGO, ILLINOIS | 10 FEB 83 | 1548.142

OPTION?



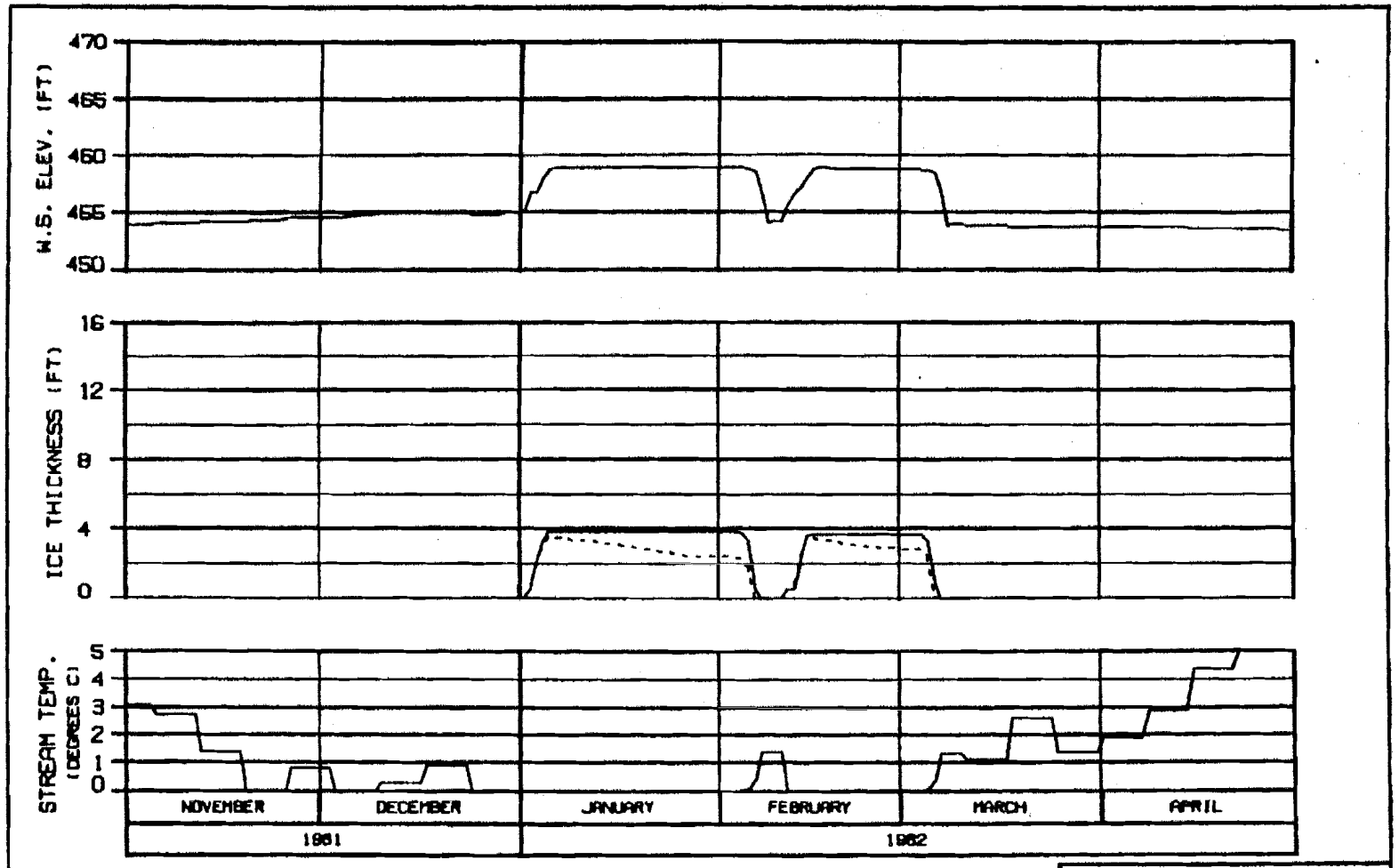
SIDE CHANNEL AT HEAD OF GASH CREEK

RIVER MILE : 112.00

ICE THICKNESS LEGEND:
——— TOTAL THICKNESS
- - - - - - SLUSH COMPONENT

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
CASE E-6-02 FLOWS TEMP: INFLOW-MATCHING
EXISTING WATANA INTAKE DESIGN
REFERENCE RUN NO. : 8102EN8

ALASKA POWER AUTHORITY		
SUSITNA PROJECT		
SUSITNA RIVER ICE SIMULATION TIME HISTORY		
HARZA-EBASCO JOINT VENTURE		
CHICAGO, ILLINOIS	[illegible]	1503.142



MOUTH OF SLOUGH 6A

RIVER MILE : 112.34

ICE THICKNESS LEGEND:

——— TOTAL THICKNESS

- - - - - - SLUSH COMPONENT

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
CASE E-6-02 FLOWS TEMP: INFLOW-MATCHING
EXISTING WATANA INTAKE DESIGN
REFERENCE RUN NO. : 8102ENB

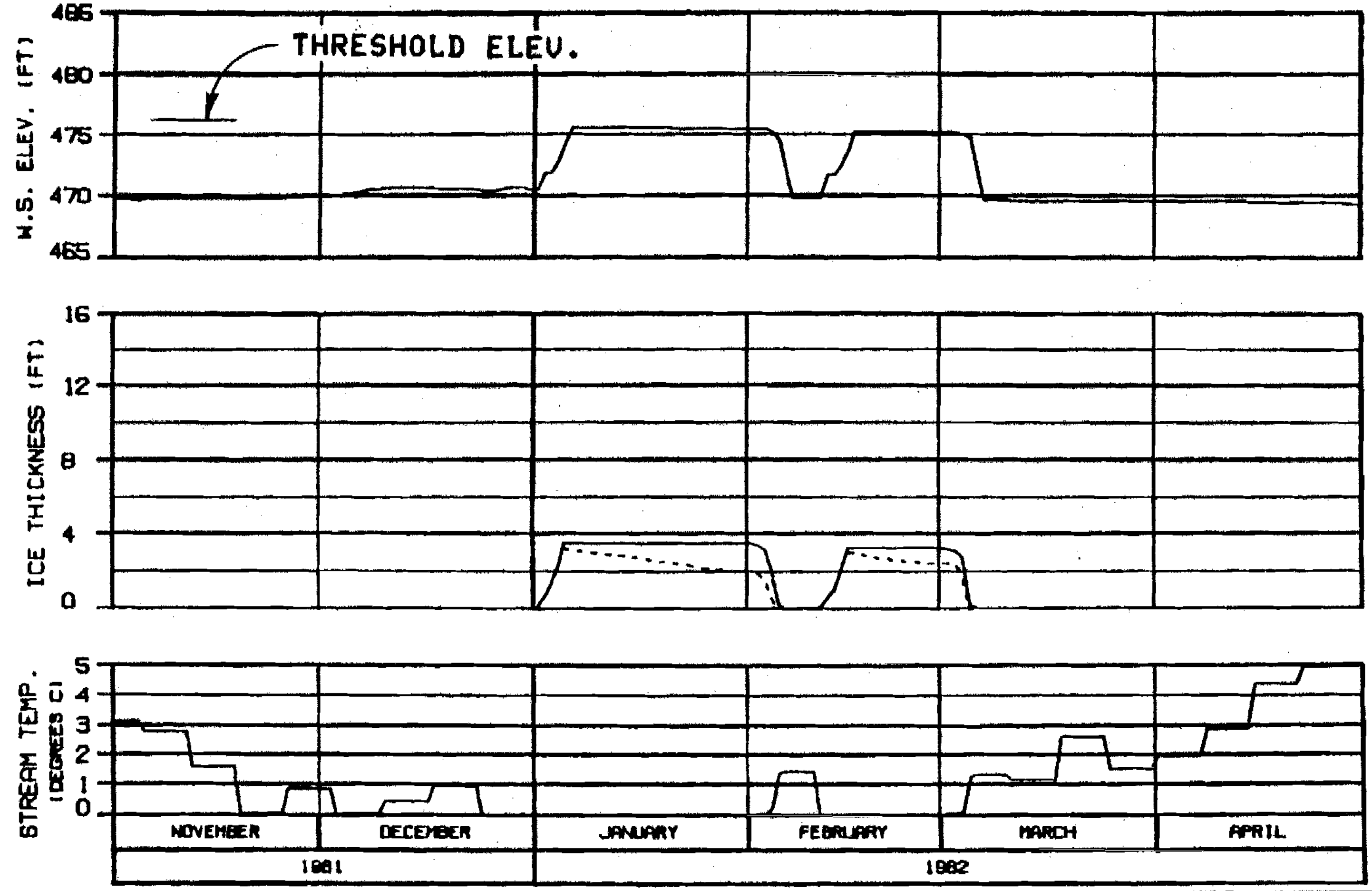
ALASKA POWER AUTHORITY

SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE

DWG NO. 1588.142



HEAD OF SLOUGH 8

RIVER MILE : 114.10

ICE THICKNESS LEGEND:

——— TOTAL THICKNESS
- - - - - - SLUSH COMPONENT

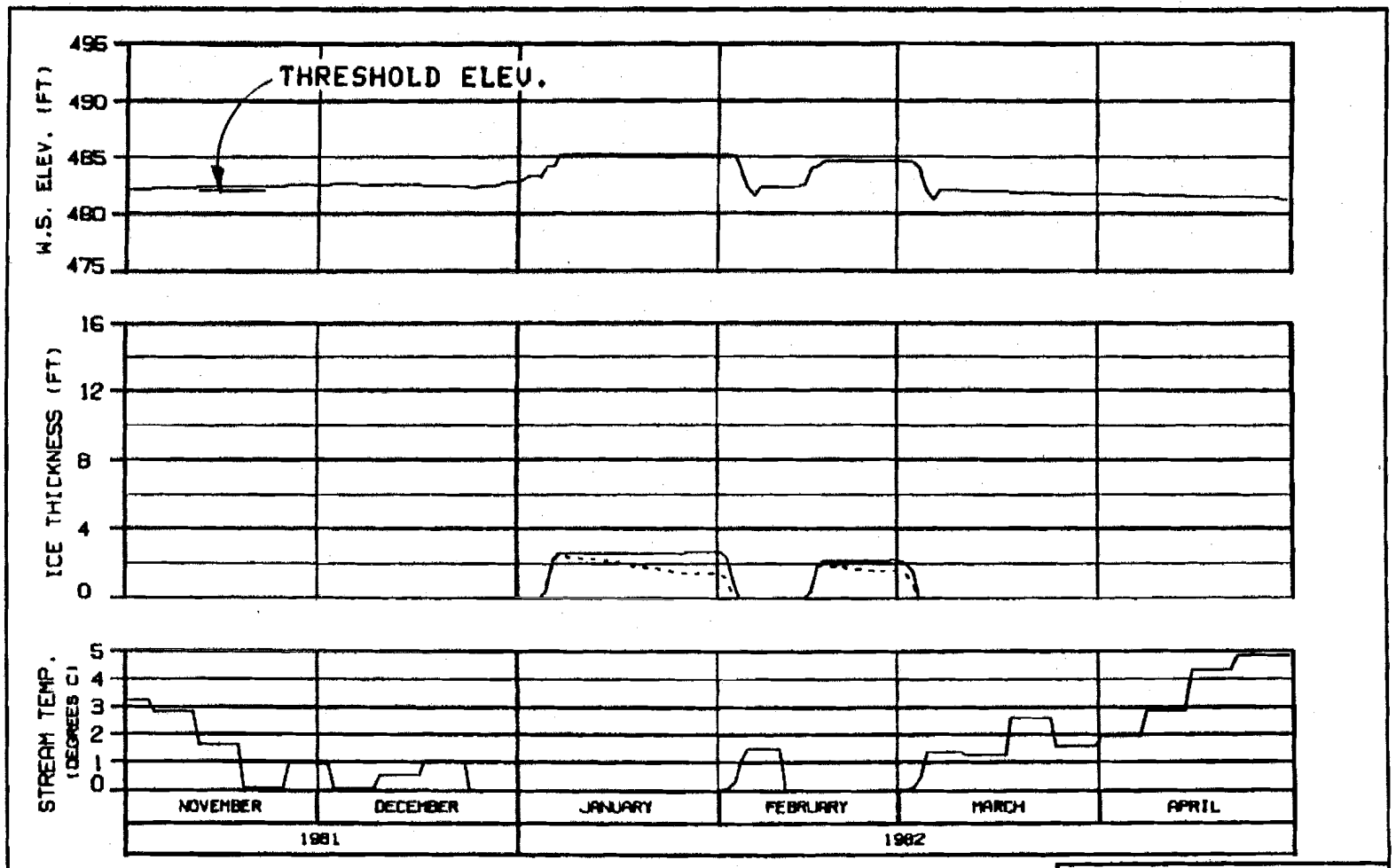
WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
CASE E-6-02 FLOWS TEMP: INFLOW-MATCHING
EXISTING WATANA INTAKE DESIGN
REFERENCE RUN NO. : 8102EN8

ALASKA POWER AUTHORITY

SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE



SIDE CHANNEL MSII

RIVER MILE : 115.50

ICE THICKNESS LEGEND:

——— TOTAL THICKNESS

- - - - - - SLUSH COMPONENT

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
CASE E-6-02 FLOWS TEMP: INFLOW-MATCHING
EXISTING WATANA INTAKE DESIGN
REFERENCE RUN NO. : 8102ENB

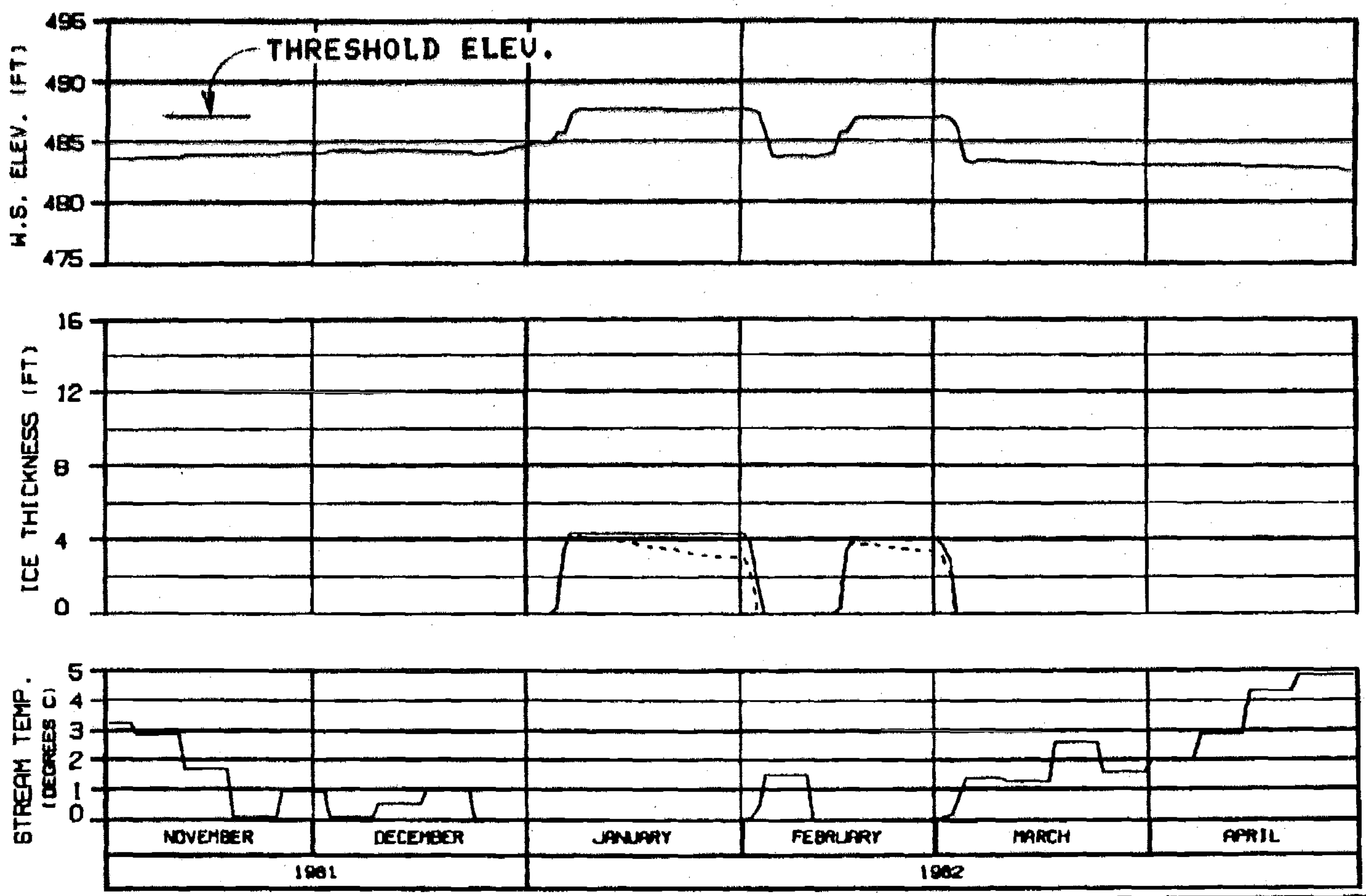
ALASKA POWER AUTHORITY

SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE

1588.142



HEAD OF SIDE CHANNEL MSII

RIVER MILE : 115.90

ICE THICKNESS LEGEND:

——— TOTAL THICKNESS
- - - - - SLUSH COMPONENT

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
CASE E-6-D2 FLOWS TEMP: INFLOW-MATCHING
EXISTING WATANA INTAKE DESIGN
REFERENCE RUN NO. : 8102EN8

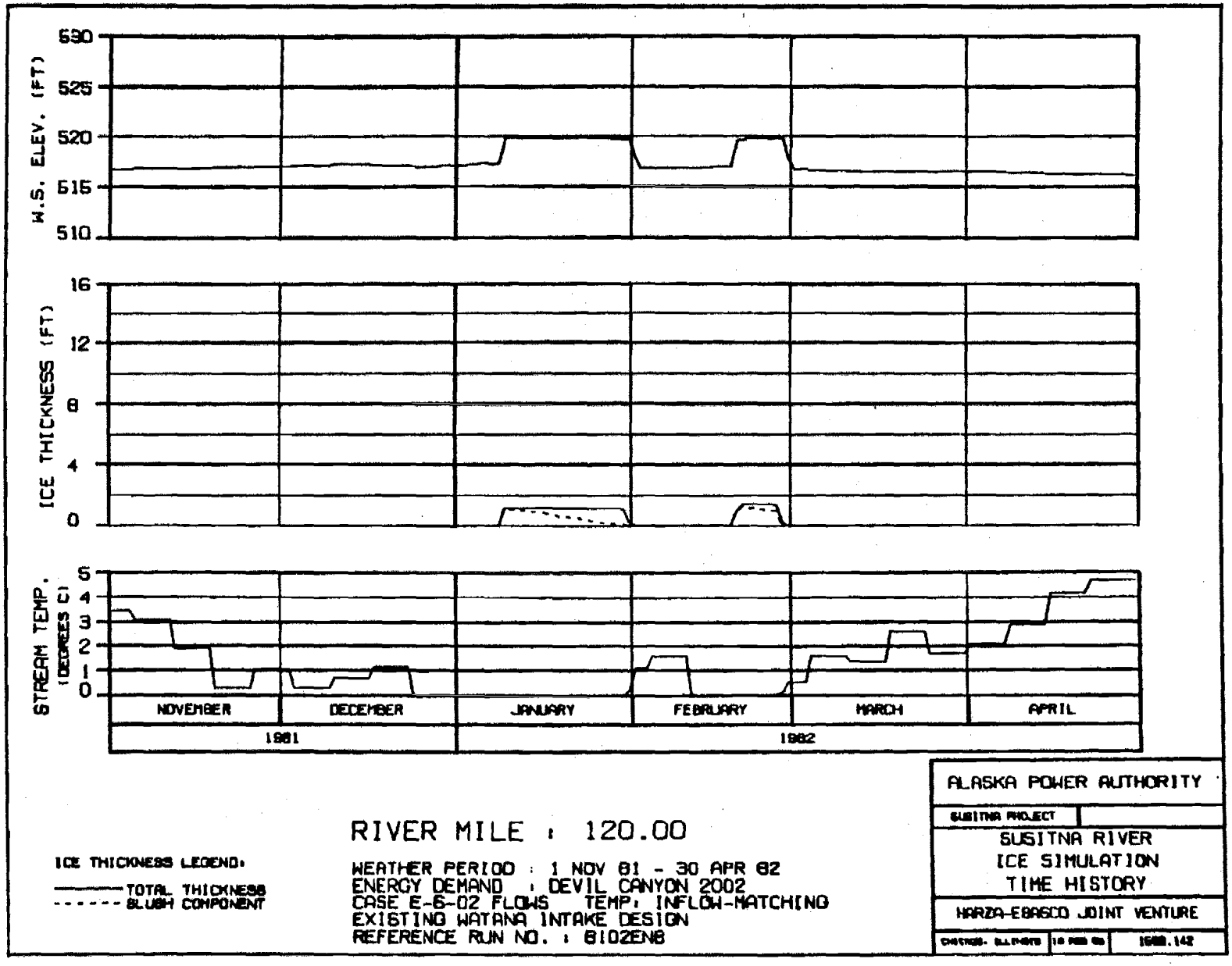
ALASKA POWER AUTHORITY

SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE

CHICAGO, ILLINOIS | 10 FEB 85 | 1593.142



ICE THICKNESS LEGEND:

——— TOTAL THICKNESS

- - - - - - SLUSH COMPONENT

RIVER MILE : 120.00

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
CASE E-6-02 FLOWS TEMP: INFLOW-MATCHING
EXISTING WATANA INTAKE DESIGN
REFERENCE RUN NO. : 8102EN8

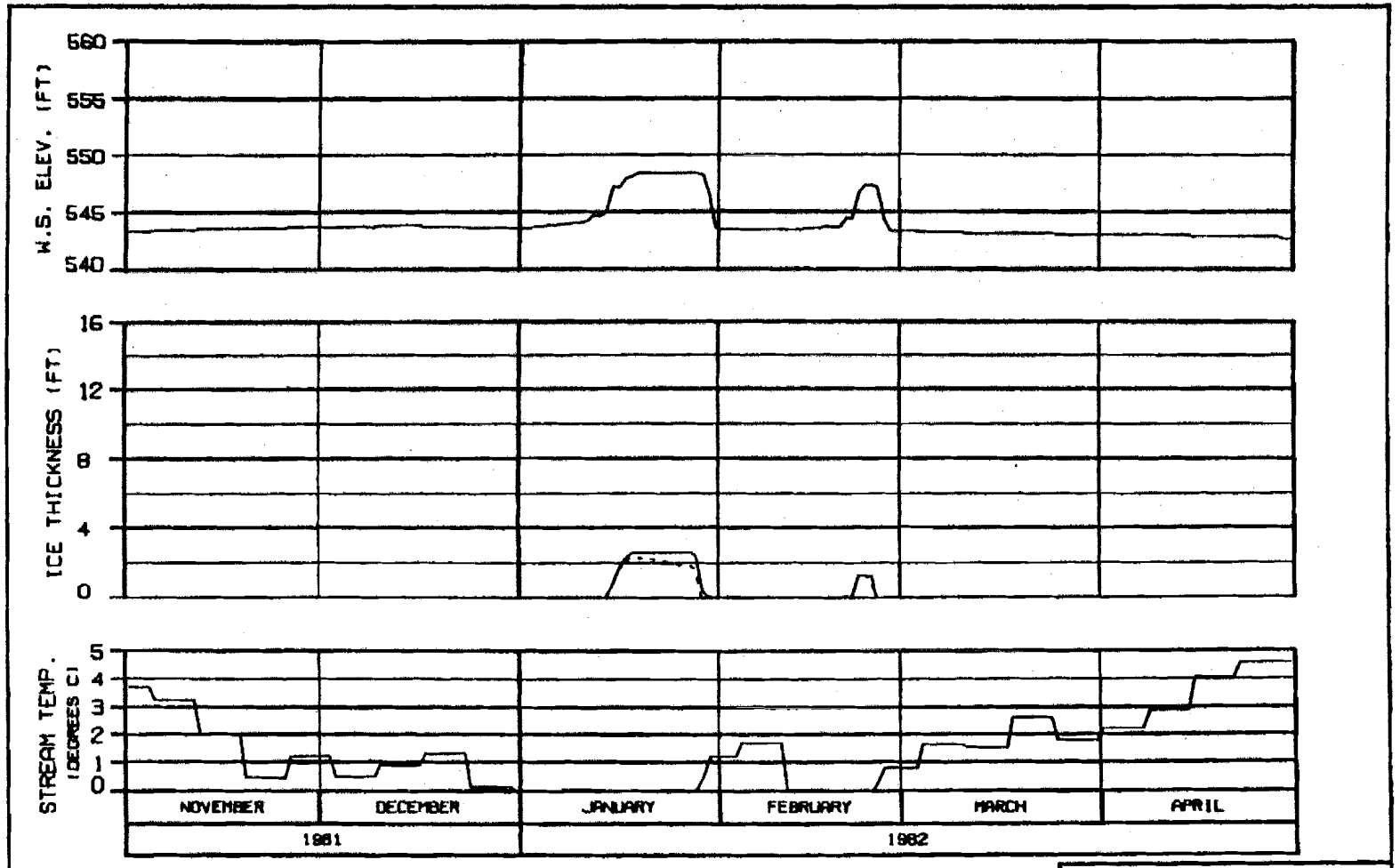
ALASKA POWER AUTHORITY

SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE

CHICAGO, ILLINOIS | 1688.142



HEAD OF MOOSE SLOUGH

RIVER MILE : 123.50

ICE THICKNESS LEGEND:

——— TOTAL THICKNESS
- - - - - - SLUSH COMPONENT

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
CASE E-6-02 FLOWS TEMP: INFLOW-MATCHING
EXISTING WATANA INTAKE DESIGN
REFERENCE RUN NO. : 8102EN8

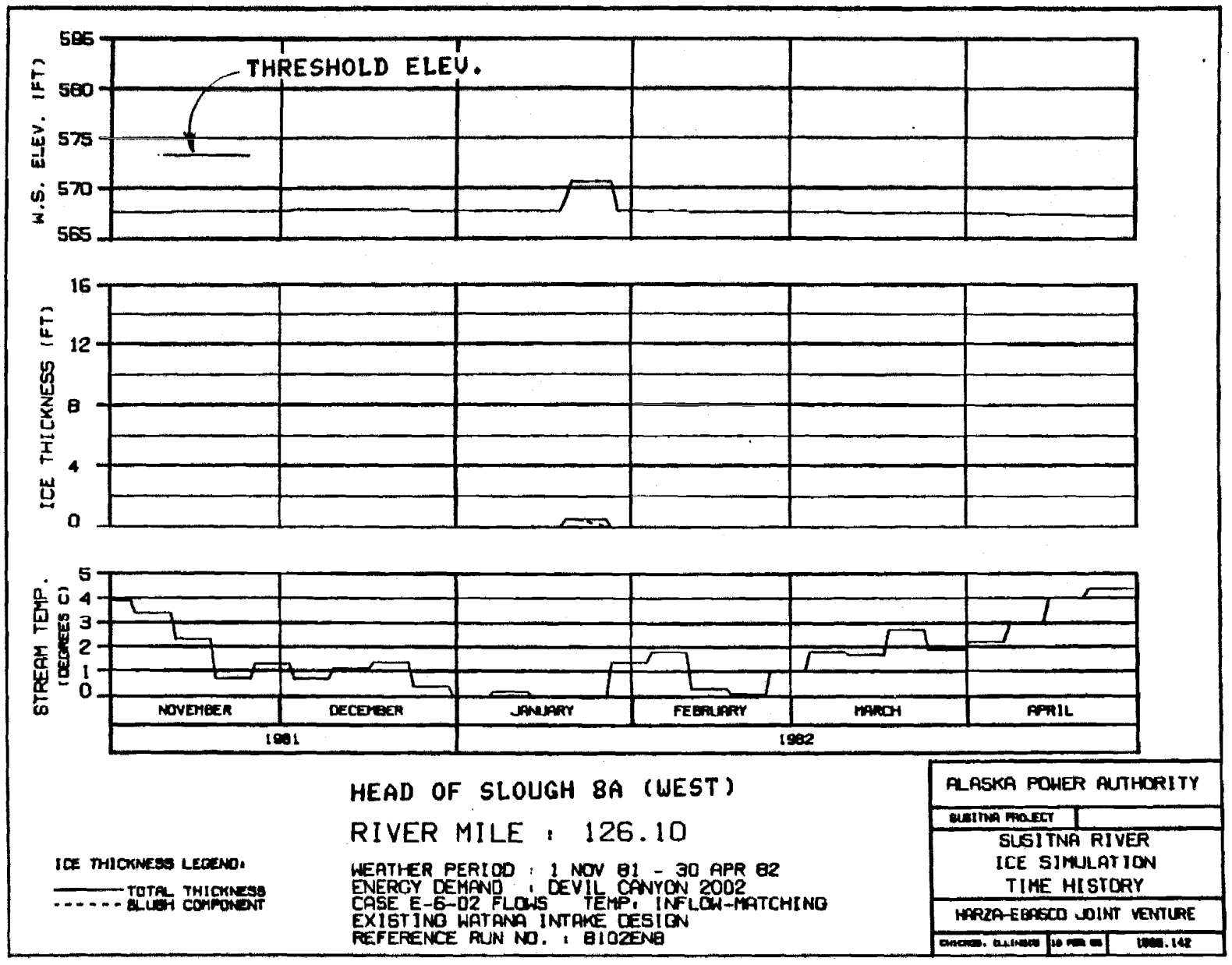
ALASKA POWER AUTHORITY

SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE

CHICAGO, ILLINOIS | 10 FEB 83 | 1868.142



HEAD OF SLOUGH 8A (WEST)

RIVER MILE : 126.10

ICE THICKNESS LEGEND:

——— TOTAL THICKNESS

- - - - - - SLUSH COMPONENT

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
CASE E-6-D2 FLOWS TEMP: INFLOW-MATCHING
EXISTING WATANA INTAKE DESIGN
REFERENCE RUN NO. : B102EN8

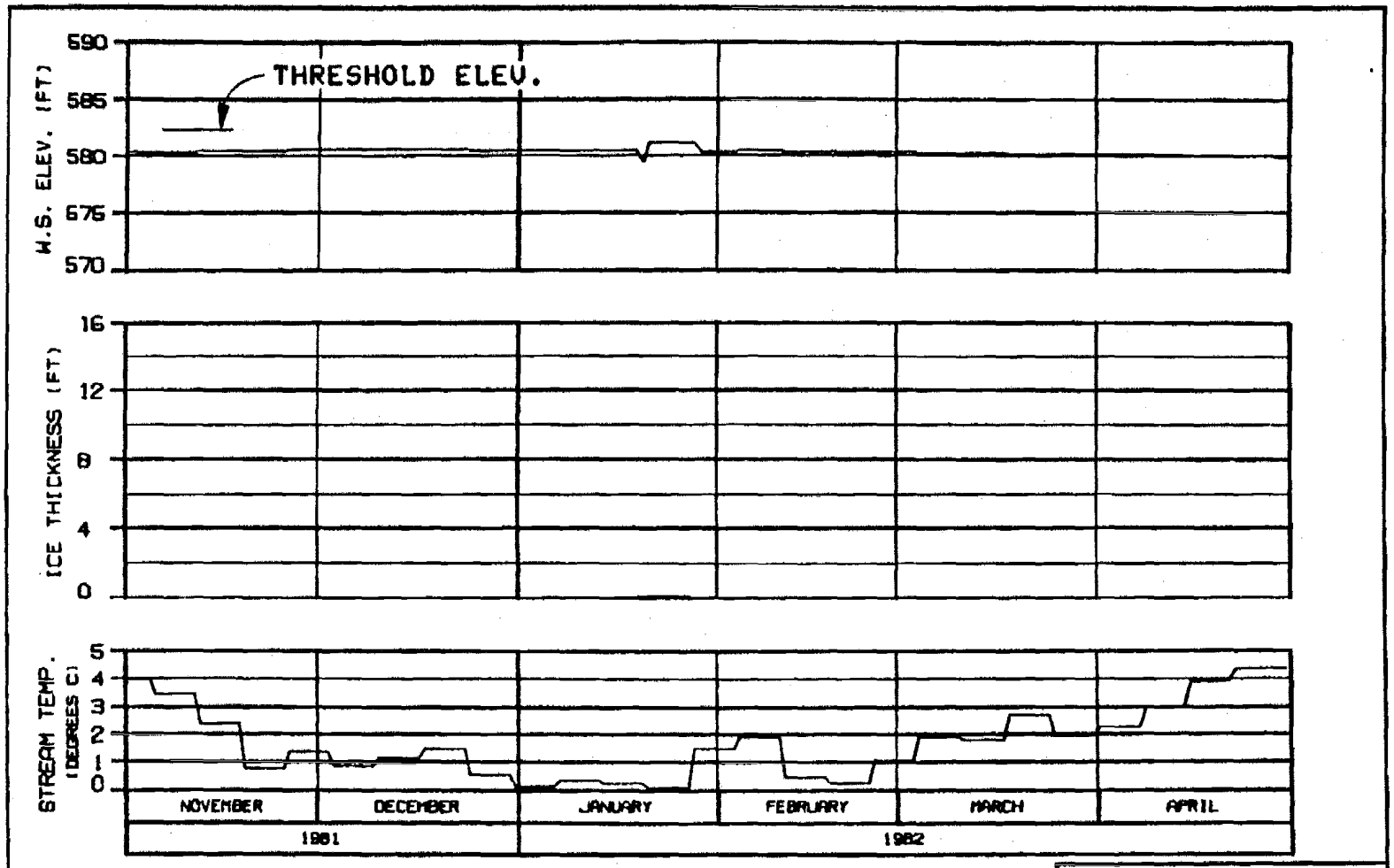
ALASKA POWER AUTHORITY

SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE

CHICAGO, ILLINOIS | 10 FEB 88 | 1988.142



HEAD OF SLOUGH 8A (EAST)

RIVER MILE : 127.10

ICE THICKNESS LEGEND:

——— TOTAL THICKNESS

- - - - - - SLUSH COMPONENT

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
CASE E-6-D2 FLOWS TEMP: INFLOW-MATCHING
EXISTING WATANA INTAKE DESIGN
REFERENCE RUN NO. : 8102EN8

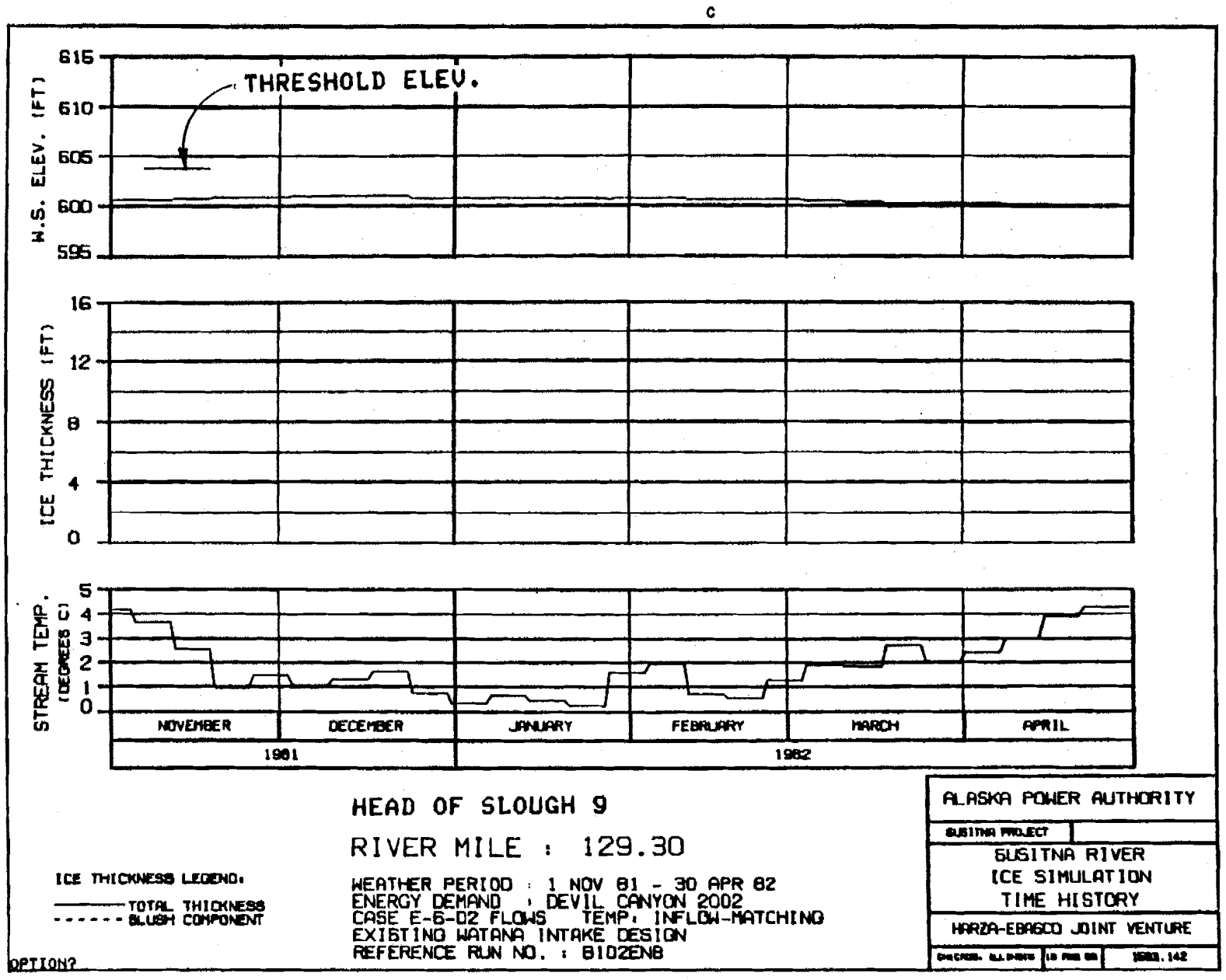
ALASKA POWER AUTHORITY

SUSITNA PROJECT

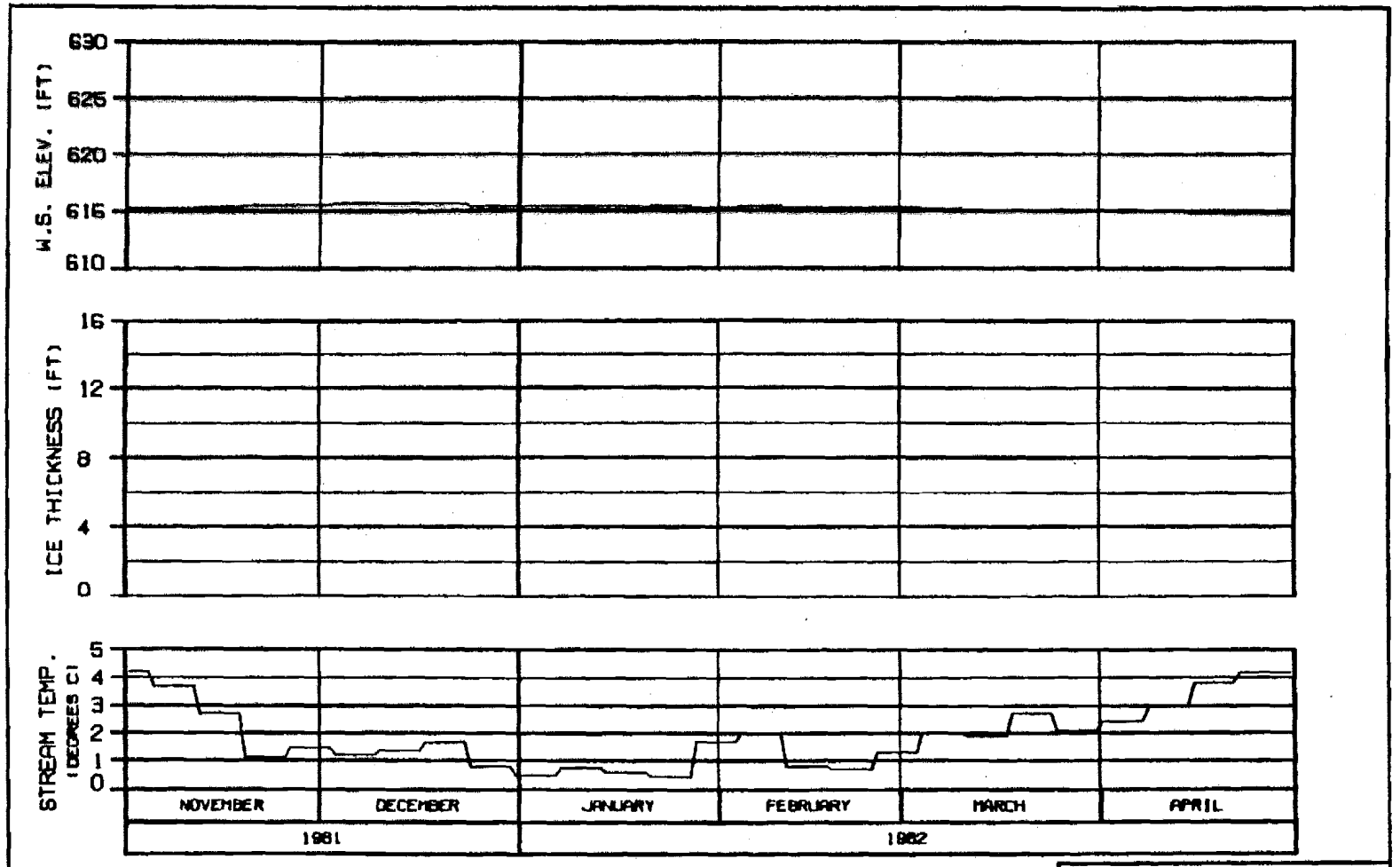
SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE

CHICAGO, ILLINOIS | 18 FEB 83 | 1588.142


C
615
610
605
600
595
W.S. ELEV. (FT)
THRESHOLD ELEV.
16
12
8
4
0
ICE THICKNESS (FT)
5
4
3
2
1
0
STREAM TEMP. (DEGREES C)
NOVEMBER
DECEMBER
JANUARY
FEBRUARY
MARCH
APRIL
1981
1982
HEAD OF SLOUGH 9
RIVER MILE : 129.30
ICE THICKNESS LEGEND:
TOTAL THICKNESS
SLUSH COMPONENT
WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
CASE E-6-D2 FLOWS TEMP: INFLOW-MATCHING
EXISTING WATANA INTAKE DESIGN
REFERENCE RUN NO. : B102ENB
OPTION?
ALASKA POWER AUTHORITY
SUSITNA PROJECT
SUSITNA RIVER
ICE SIMULATION
TIME HISTORY
HARZA-EBASCO JOINT VENTURE

OPTION?



SIDE CHANNEL U/S OF SLOUGH 9

RIVER MILE : 130.60

ICE THICKNESS LEGEND:

——— TOTAL THICKNESS

- - - - - - SLUSH COMPONENT

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
CASE E-6-02 FLOWS TEMP: INFLOW-MATCHING
EXISTING WATANA INTAKE DESIGN
REFERENCE RUN NO. : 8102ENB

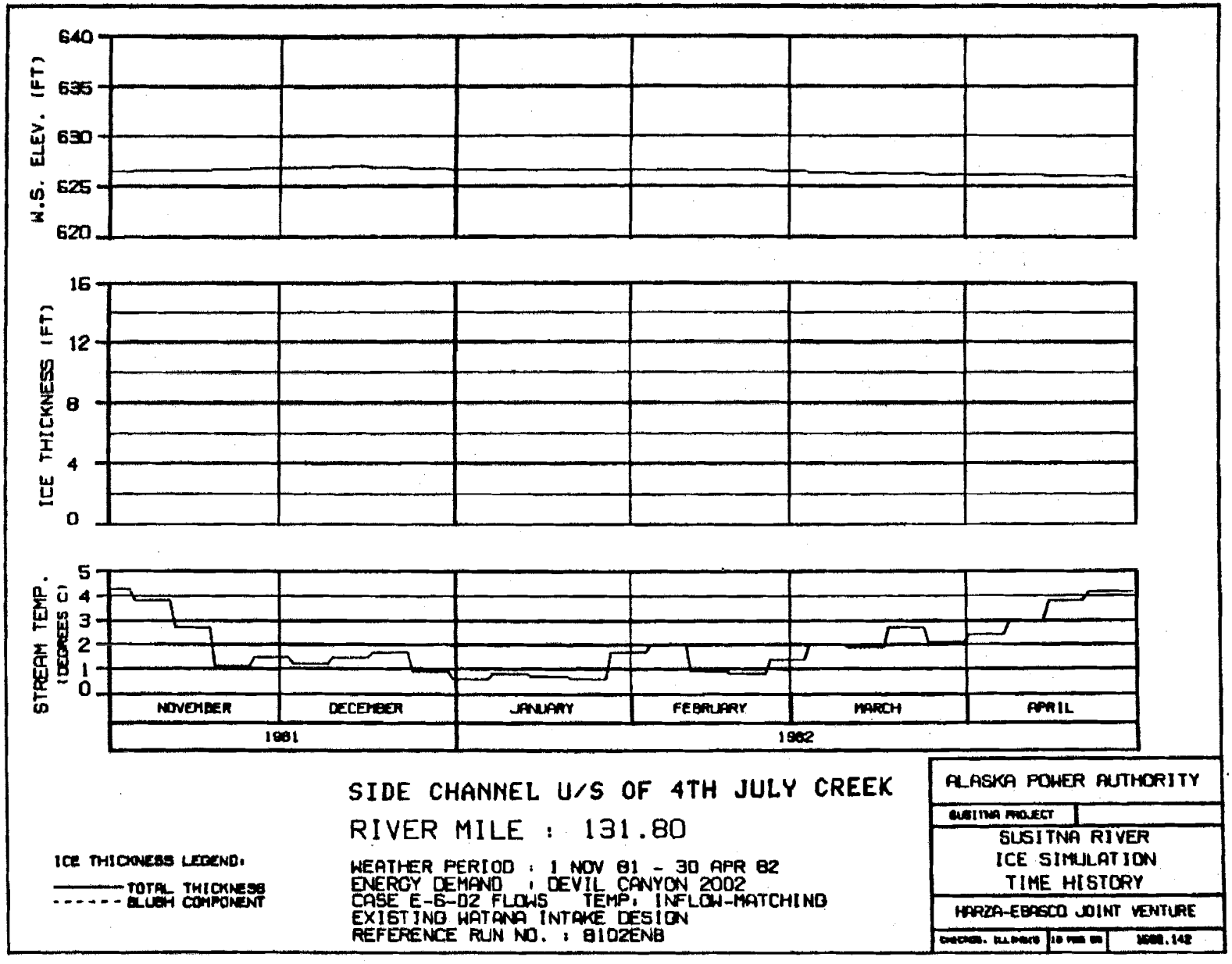
ALASKA POWER AUTHORITY

SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE

[illegible] | 18 FEB 85 | 1588.142



SIDE CHANNEL U/S OF 4TH JULY CREEK

RIVER MILE : 131.80

ICE THICKNESS LEGEND:

——— TOTAL THICKNESS

- - - - - - SLUSH COMPONENT

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
CASE E-6-02 FLOWS TEMP: INFLOW-MATCHING
EXISTING WATANA INTAKE DESIGN
REFERENCE RUN NO. : 8102ENB

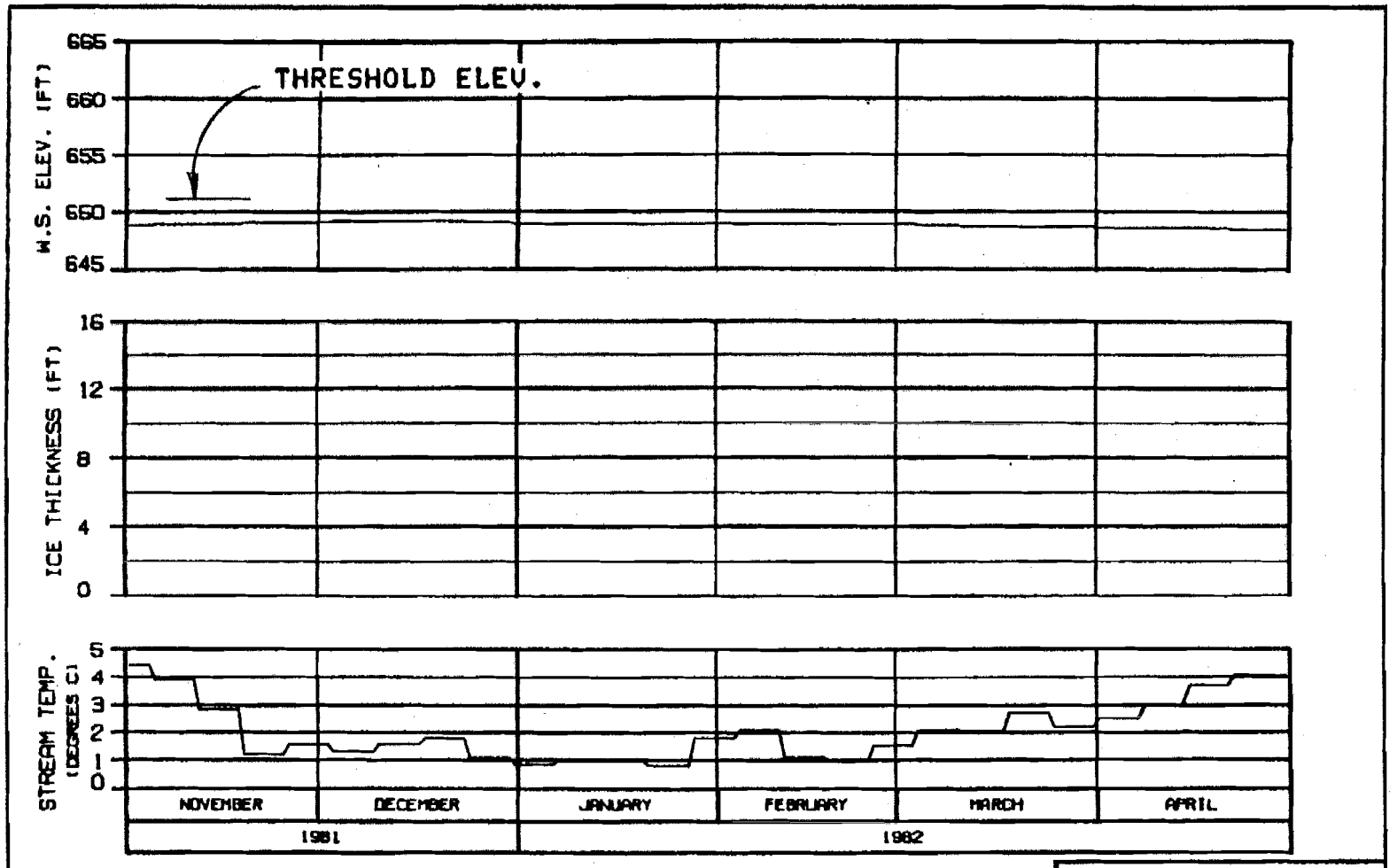
ALASKA POWER AUTHORITY

SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE

1698.142



HEAD OF SLOUGH 9A

RIVER MILE : 133.70

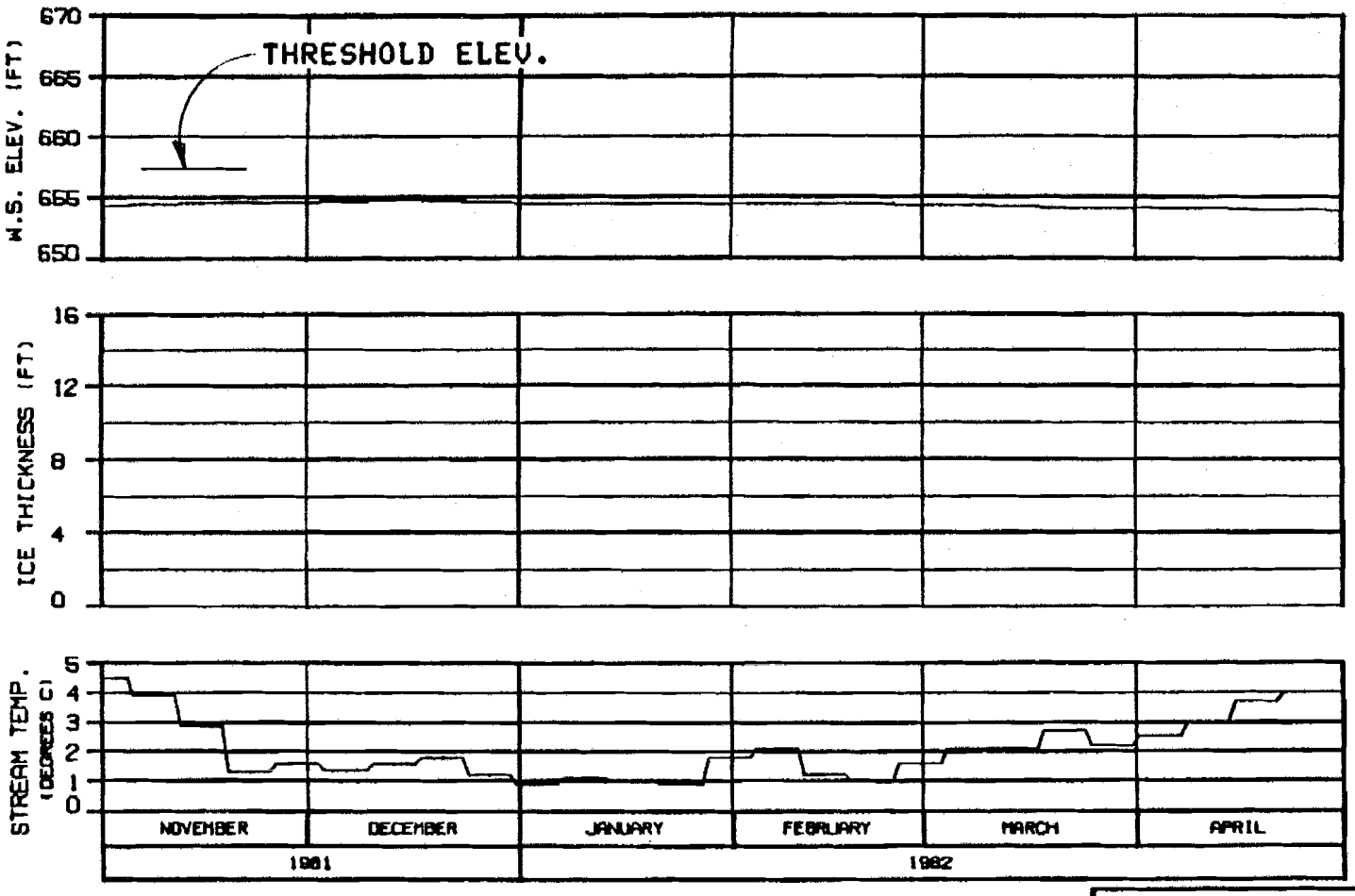
ICE THICKNESS LEGEND:

——— TOTAL THICKNESS

- - - - - - SLUSH COMPONENT

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
CASE E-6-02 FLOWS TEMP: INFLOW-MATCHING
EXISTING WATANA INTAKE DESIGN
REFERENCE RUN NO. : 8102ENB

ALASKA POWER AUTHORITY	
SUSITNA PROJECT	
SUSITNA RIVER ICE SIMULATION TIME HISTORY	
HARZA-EBASCO JOINT VENTURE	
CHICAGO, ILLINOIS	1988.142



SIDE CHANNEL U/S OF SLOUGH 10

RIVER MILE : 134.30

ICE THICKNESS LEGEND:

——— TOTAL THICKNESS

- - - - - SLUSH COMPONENT

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
CASE E-6-D2 FLOWS TEMP: INFLOW-MATCHING
EXISTING WATANA INTAKE DESIGN
REFERENCE RUN NO. : B102EN8

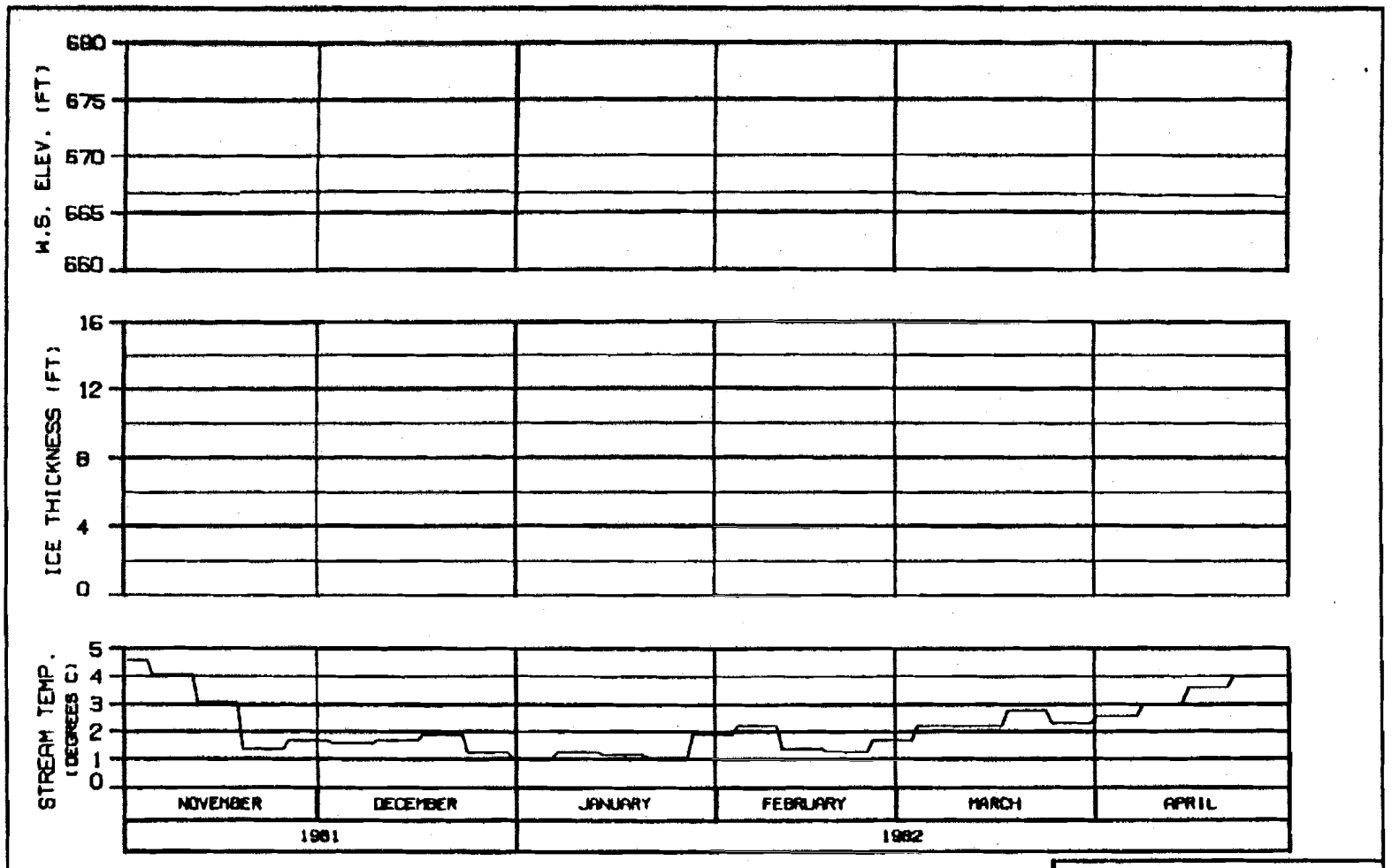
ALASKA POWER AUTHORITY

SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE

CHICAGO, ILLINOIS | 10 FEB 88 | 1888.142



SIDE CHANNEL D/S OF SLOUGH 11

RIVER MILE : 135.30

ICE THICKNESS LEGEND:

——— TOTAL THICKNESS
- - - - - - SLUSH COMPONENT

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
CASE E-6-02 FLOWS TEMP: INFLOW-MATCHING
EXISTING WATANA INTAKE DESIGN
REFERENCE RUN NO. : B102EN8

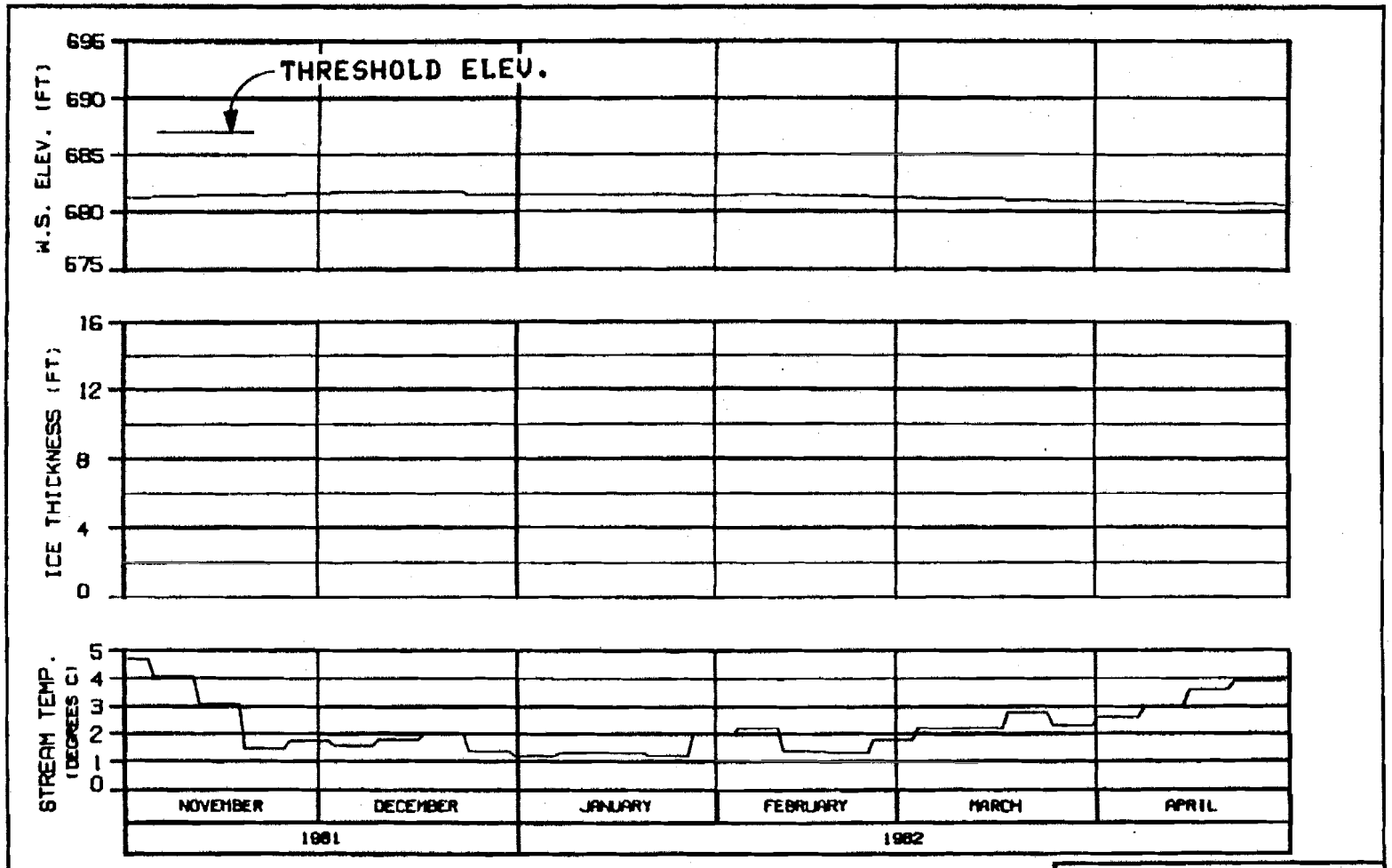
ALASKA POWER AUTHORITY

SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE

1588.142



HEAD OF SLOUGH 11

RIVER MILE : 136.50

ICE THICKNESS LEGEND:

——— TOTAL THICKNESS

- - - - - - SLUSH COMPONENT

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
CASE E-6-02 FLOWS TEMP: INFLOW-MATCHING
EXISTING WATANA INTAKE DESIGN
REFERENCE RUN NO. : 8102ENB

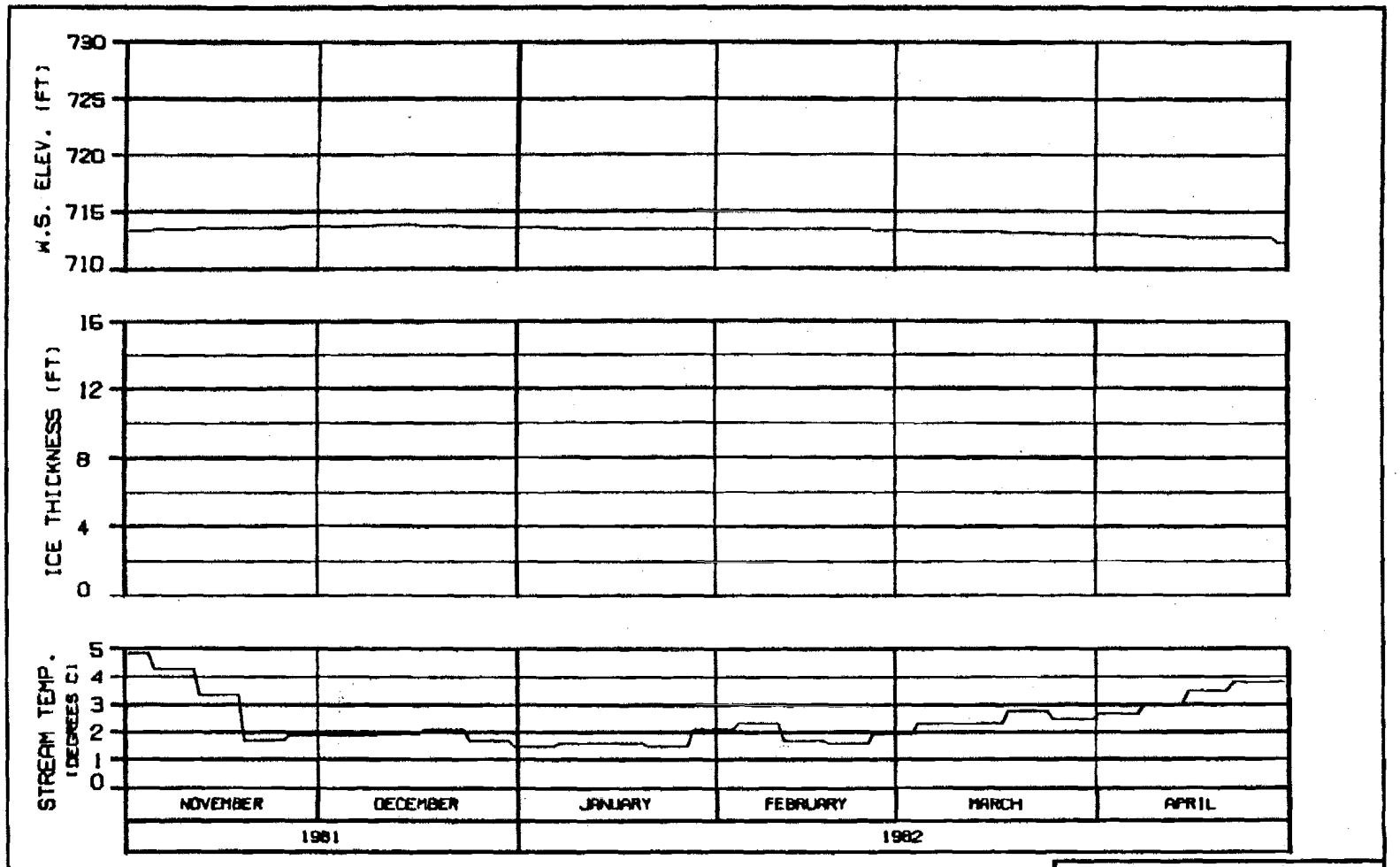
ALASKA POWER AUTHORITY

SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE

CHICAGO, ILLINOIS | 10 FEB 83 | 1588.142



HEAD OF SLOUGH 17

RIVER MILE : 139.30

ICE THICKNESS LEGEND:

——— TOTAL THICKNESS

- - - - - - SLUSH COMPONENT

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
CASE E-6-02 FLOWS TEMP: INFLOW-MATCHING
EXISTING WATANA INTAKE DESIGN
REFERENCE RUN NO. : B102EN8

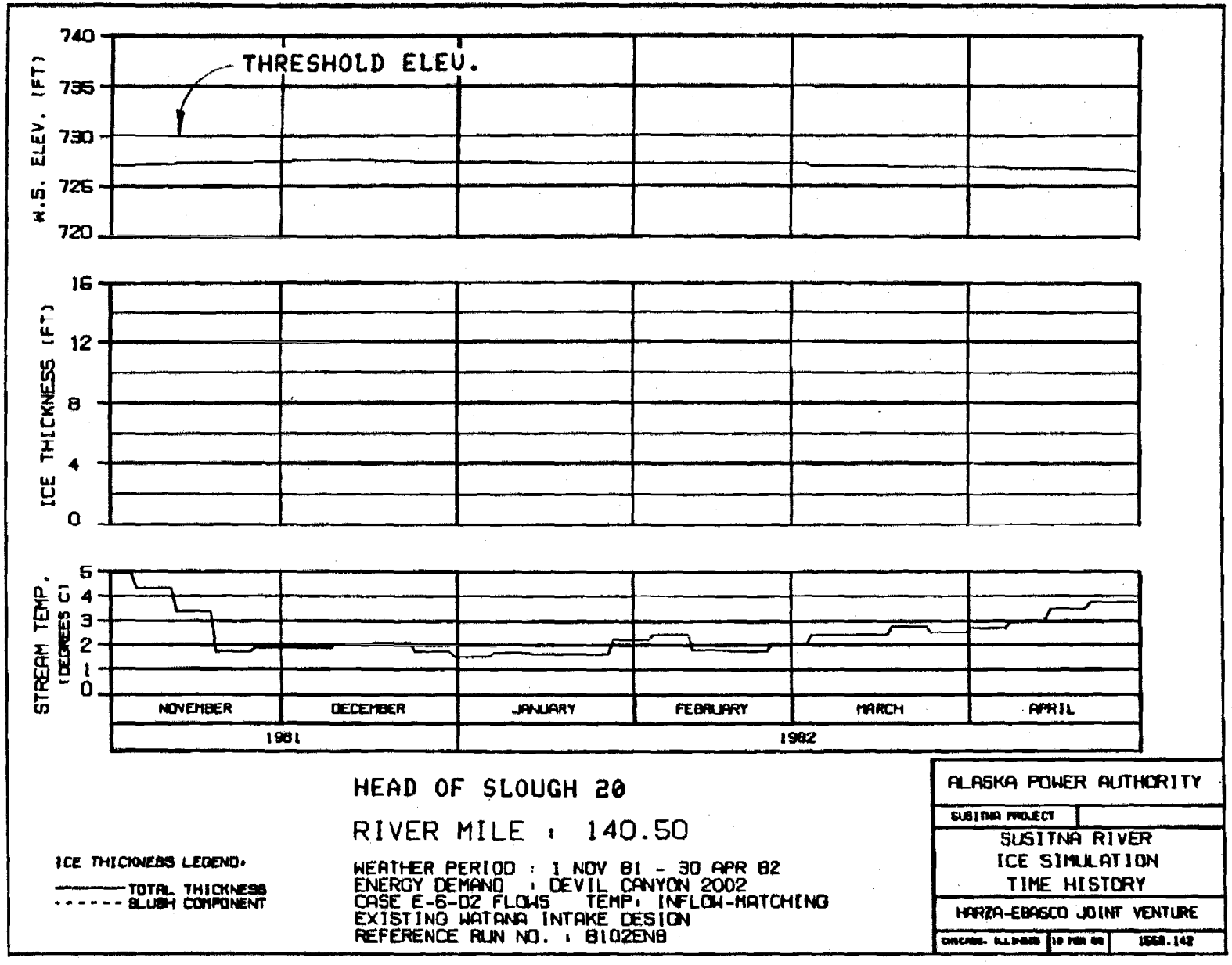
ALASKA POWER AUTHORITY

SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE

1589.142



HEAD OF SLOUGH 20

RIVER MILE : 140.50

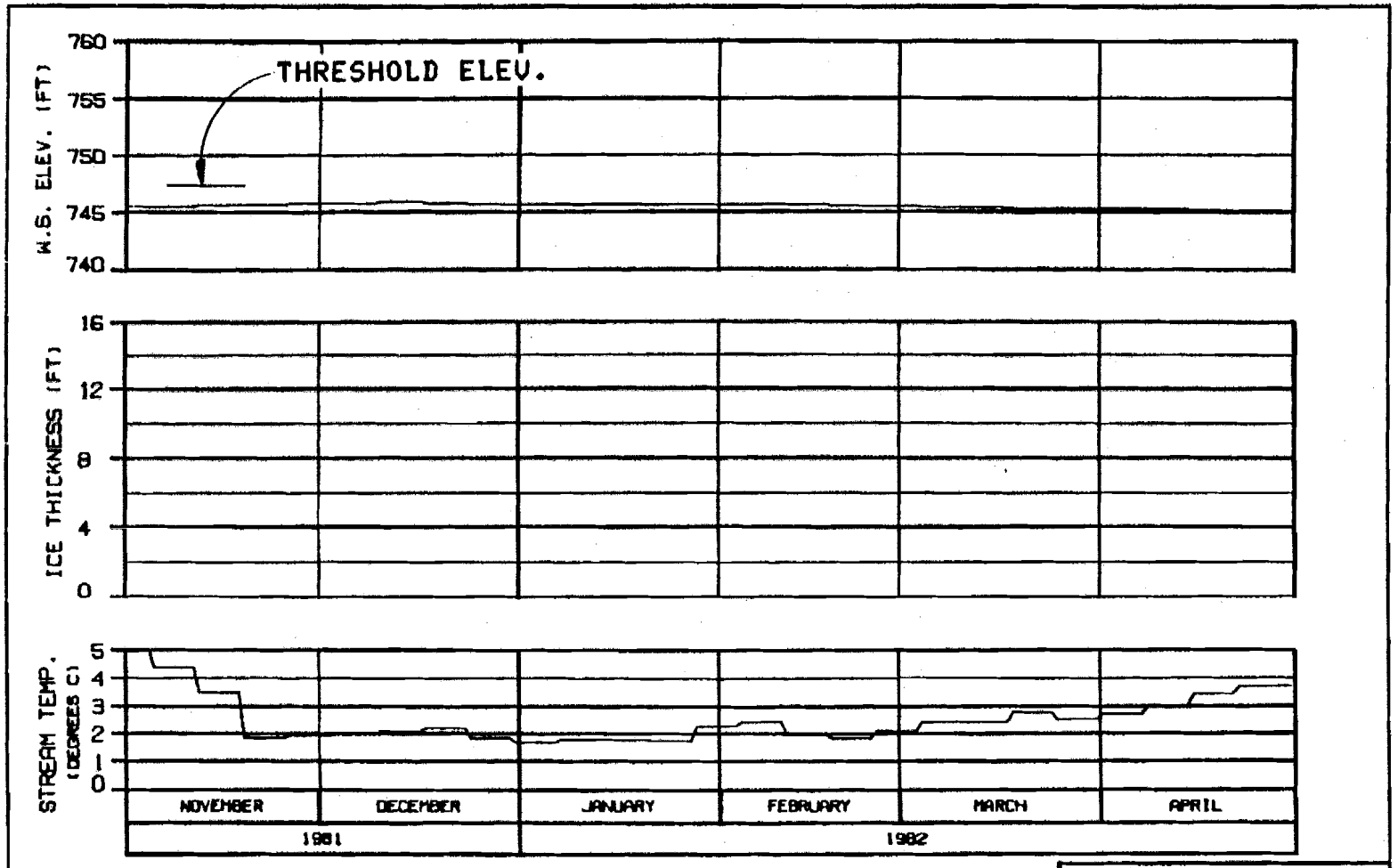
ICE THICKNESS LEGEND:

——— TOTAL THICKNESS

- - - - - SLUSH COMPONENT

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
CASE E-6-02 FLOWS TEMP: INFLOW-MATCHING
EXISTING WATANA INTAKE DESIGN
REFERENCE RUN NO. : B102ENB

ALASKA POWER AUTHORITY	
SUSITNA PROJECT	
SUSITNA RIVER ICE SIMULATION TIME HISTORY	
HARZA-EBASCO JOINT VENTURE	
CHICAGO, ILLINOIS	1668.142



SLOUGH 21 (ENTRANCE A6)

RIVER MILE : 141.80

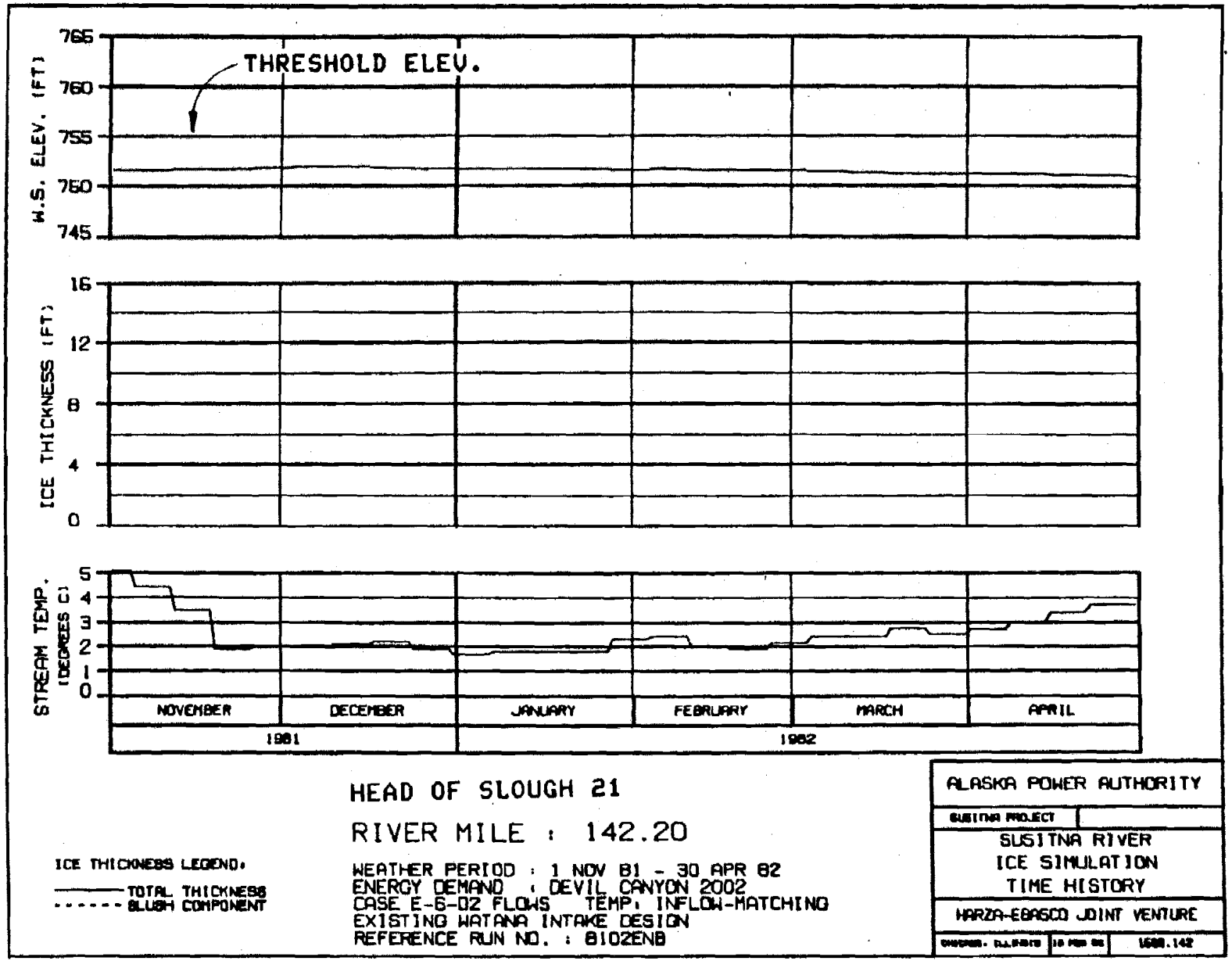
ICE THICKNESS LEGEND:

——— TOTAL THICKNESS

- - - - - - SLUSH COMPONENT

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
CASE E-6-02 FLOWS TEMP: INFLOW-MATCHING
EXISTING WATANA INTAKE DESIGN
REFERENCE RUN NO. : 8102ENB

ALASKA POWER AUTHORITY	
SUSITNA PROJECT	
SUSITNA RIVER ICE SIMULATION TIME HISTORY	
HARZA-EBASCO JOINT VENTURE	
[illegible]	1668.142



HEAD OF SLOUGH 21

RIVER MILE : 142.20

ICE THICKNESS LEGEND:

——— TOTAL THICKNESS

- - - - - - SLUSH COMPONENT

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
CASE E-6-02 FLOWS TEMP: INFLOW-MATCHING
EXISTING WATANA INTAKE DESIGN
REFERENCE RUN NO. : 8102ENB

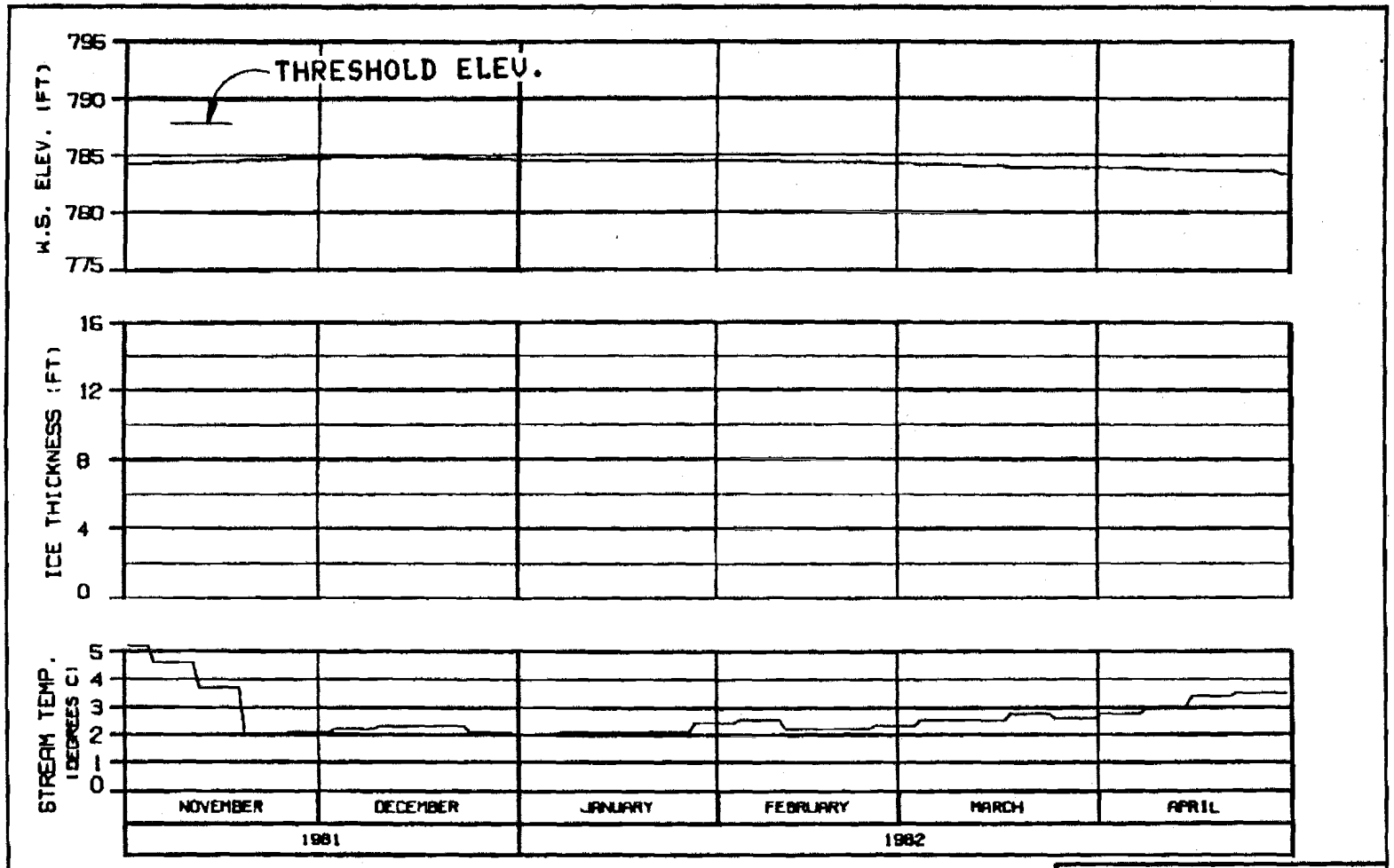
ALASKA POWER AUTHORITY

SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE

1688.142



HEAD OF SLOUGH 22

RIVER MILE : 144.80

ICE THICKNESS LEGEND:

——— TOTAL THICKNESS

- - - - - - SLUSH COMPONENT

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
CASE E-6-D2 FLOWS TEMP: INFLOW-MATCHING
EXISTING WATANA INTAKE DESIGN
REFERENCE RUN NO. : 8102EN8

OPTION2

ALASKA POWER AUTHORITY

SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE

CHICAGO, ILLINOIS | 10 FEB 83 | 1968.142

Exhibit H-7

CASE C RIVER ICE SIMULATIONS

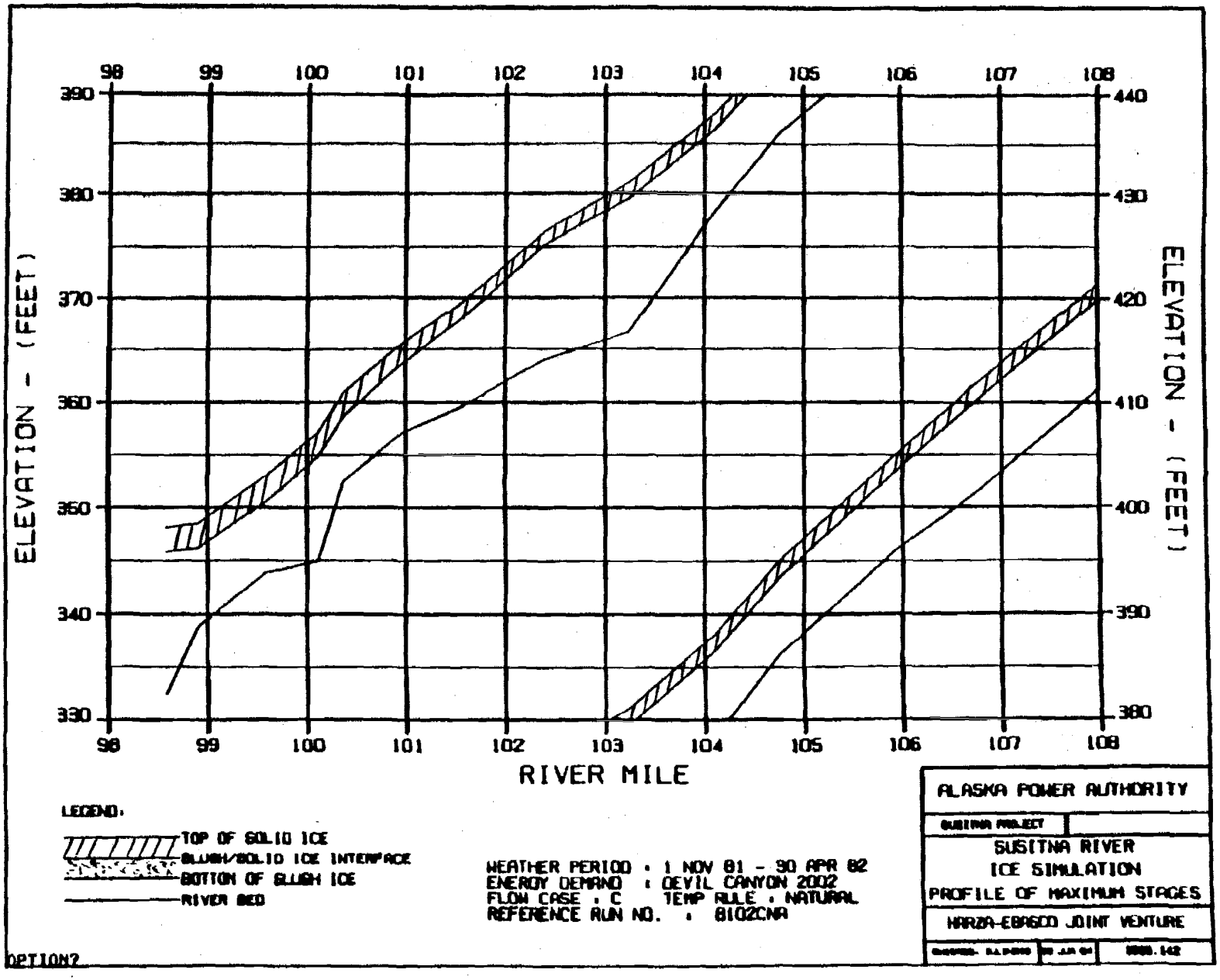
FOR

PROJECTED ENERGY DEMANDS - YEAR 2002

- Profiles of Maximum Stages (5 sheets)
- Progression of Ice Front and Zero Degree Isotherm (1)
- Time History (22 locations)

Note: Simulations are based on hydrologic and meterologic data from the period November 1981 to May 1982.

C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104
105
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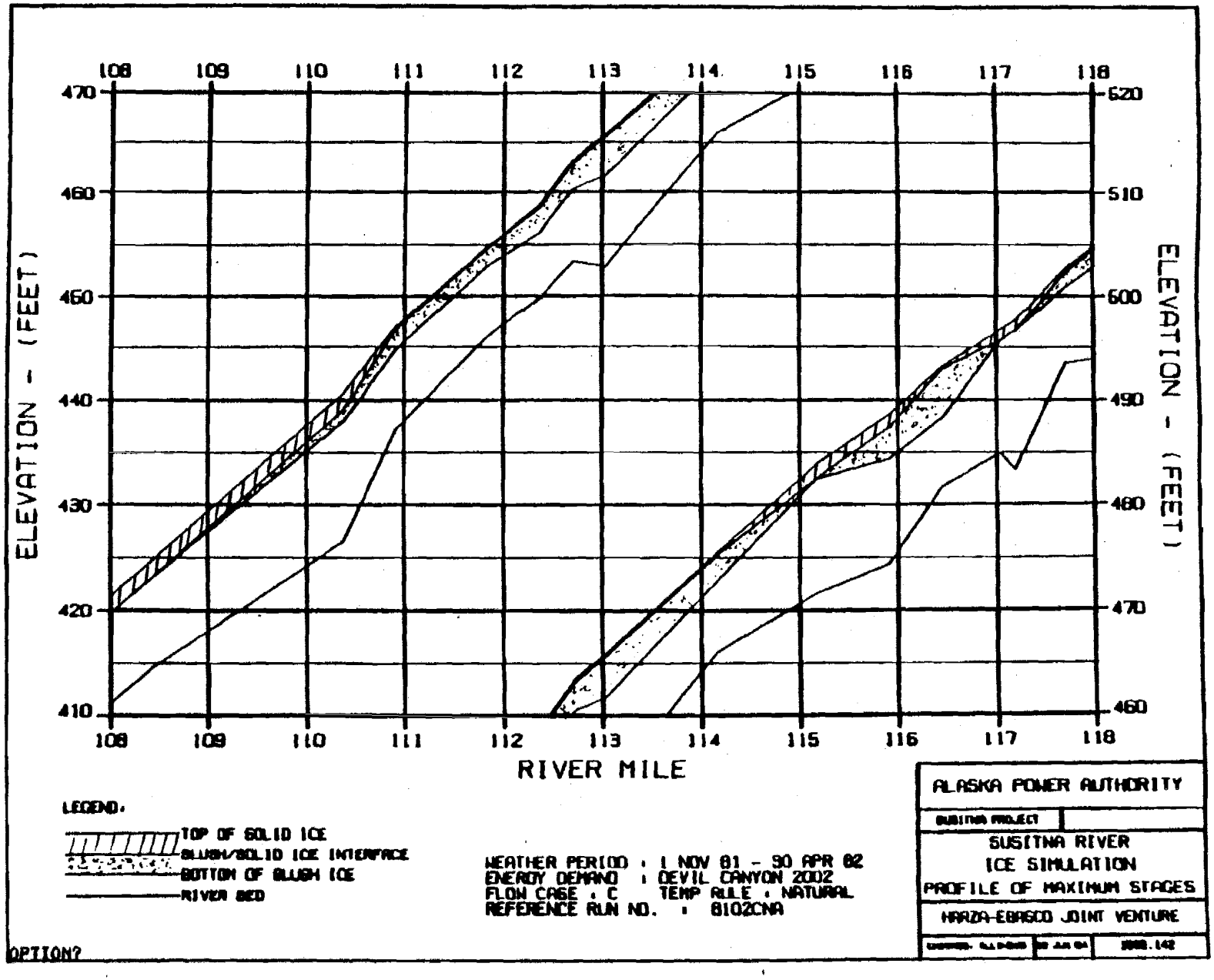
107
108
390
380
370
360
350
340
330
440
430
420
410
400
390
380
ELEVATION - (FEET)
ELEVATION - (FEET)
RIVER MILE
LEGEND:
TOP OF SOLID ICE
SLUSH/SOLID ICE INTERFACE
BOTTOM OF SLUSH ICE
RIVER BED
WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE : C TEMP RULE : NATURAL
REFERENCE RUN NO. : 8102CNA
ALASKA POWER AUTHORITY
SUSITNA PROJECT
SUSITNA RIVER
ICE SIMULATION
PROFILE OF MAXIMUM STAGES
HARZA-EBASCO JOINT VENTURE
OPTION2

C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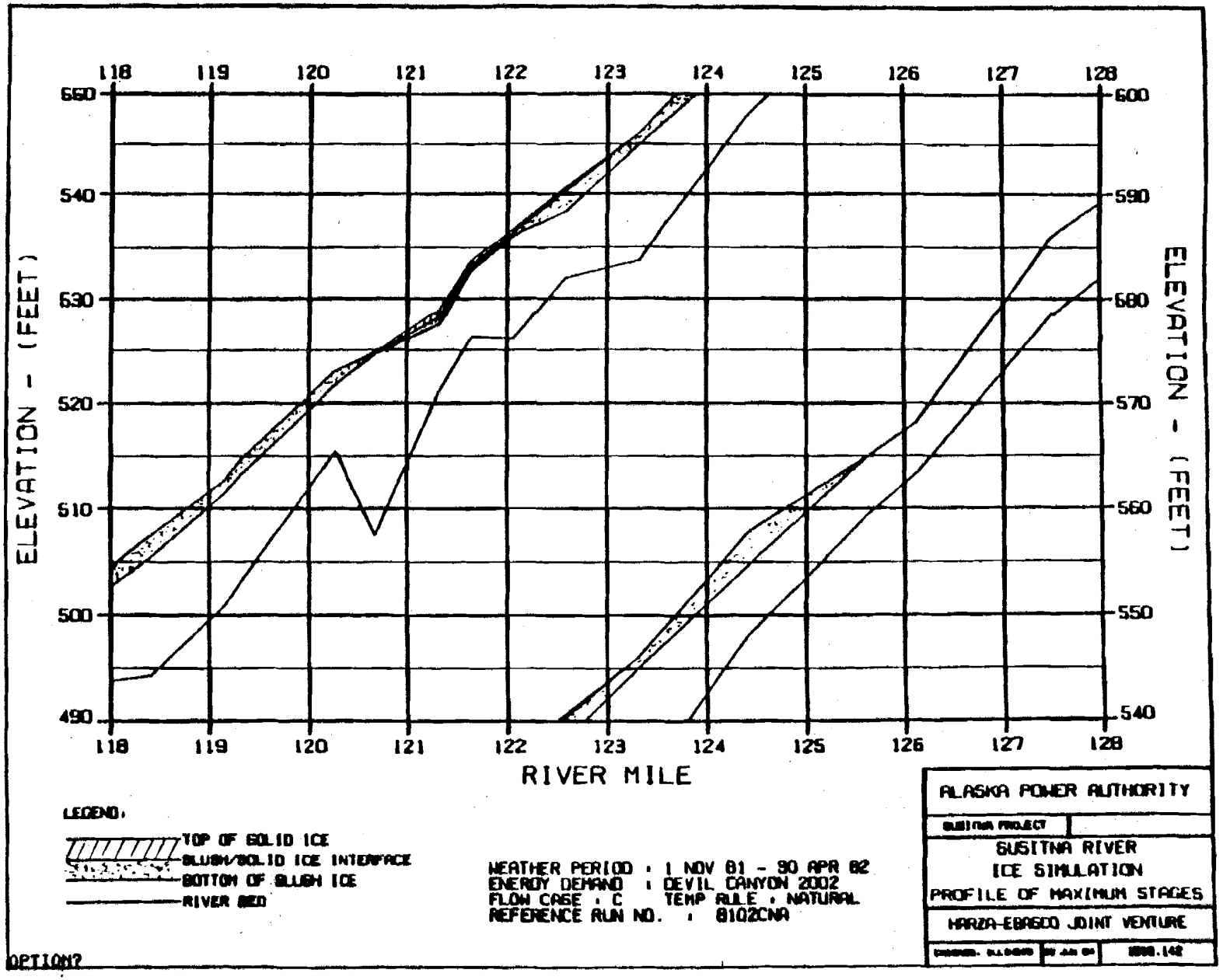
117
118
470
460
450
440
430
420
410
620
510
600
490
480
470
460
ELEVATION - (FEET)
ELEVATION - (FEET)
RIVER MILE
LEGEND:
TOP OF SOLID ICE
SLUSH/SOLID ICE INTERFACE
BOTTOM OF SLUSH ICE
RIVER BED
WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE : C TEMP RULE : NATURAL
REFERENCE RUN NO. : 8102CNA
ALASKA POWER AUTHORITY
SUSITNA PROJECT
SUSITNA RIVER
ICE SIMULATION
PROFILE OF MAXIMUM STAGES
HARZA-EBASCO JOINT VENTURE
OPTION?

C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128
660
540
630
520
510
500
490
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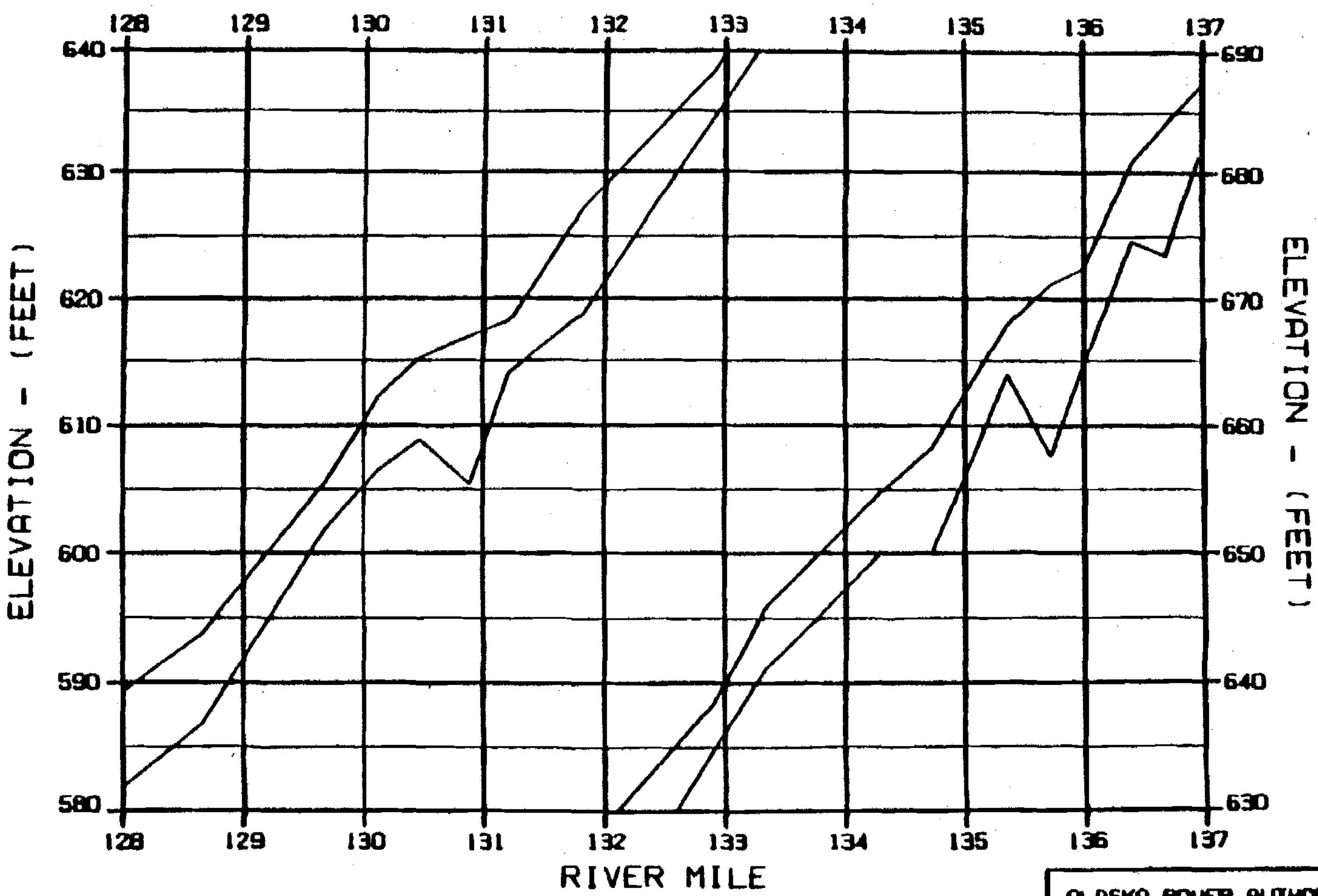
590
580
570
560
550
540
ELEVATION - (FEET)
ELEVATION - (FEET)
RIVER MILE
LEGEND:
TOP OF SOLID ICE
SLUSH/SOLID ICE INTERFACE
BOTTOM OF SLUSH ICE
RIVER BED
WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE : C TEMP RULE : NATURAL
REFERENCE RUN NO. : 8102CNA
ALASKA POWER AUTHORITY
SUSITNA PROJECT
SUSITNA RIVER
ICE SIMULATION
PROFILE OF MAXIMUM STAGES
HARZA-EBASCO JOINT VENTURE

OPTION?

C



LEGEND:

TOP OF SOLID ICE
SLUSH/SOLID ICE INTERFACE
BOTTOM OF SLUSH ICE
RIVER BED

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE : C TEMP RULE : NATURAL
REFERENCE RUN NO. : 8102CNA

ALASKA POWER AUTHORITY

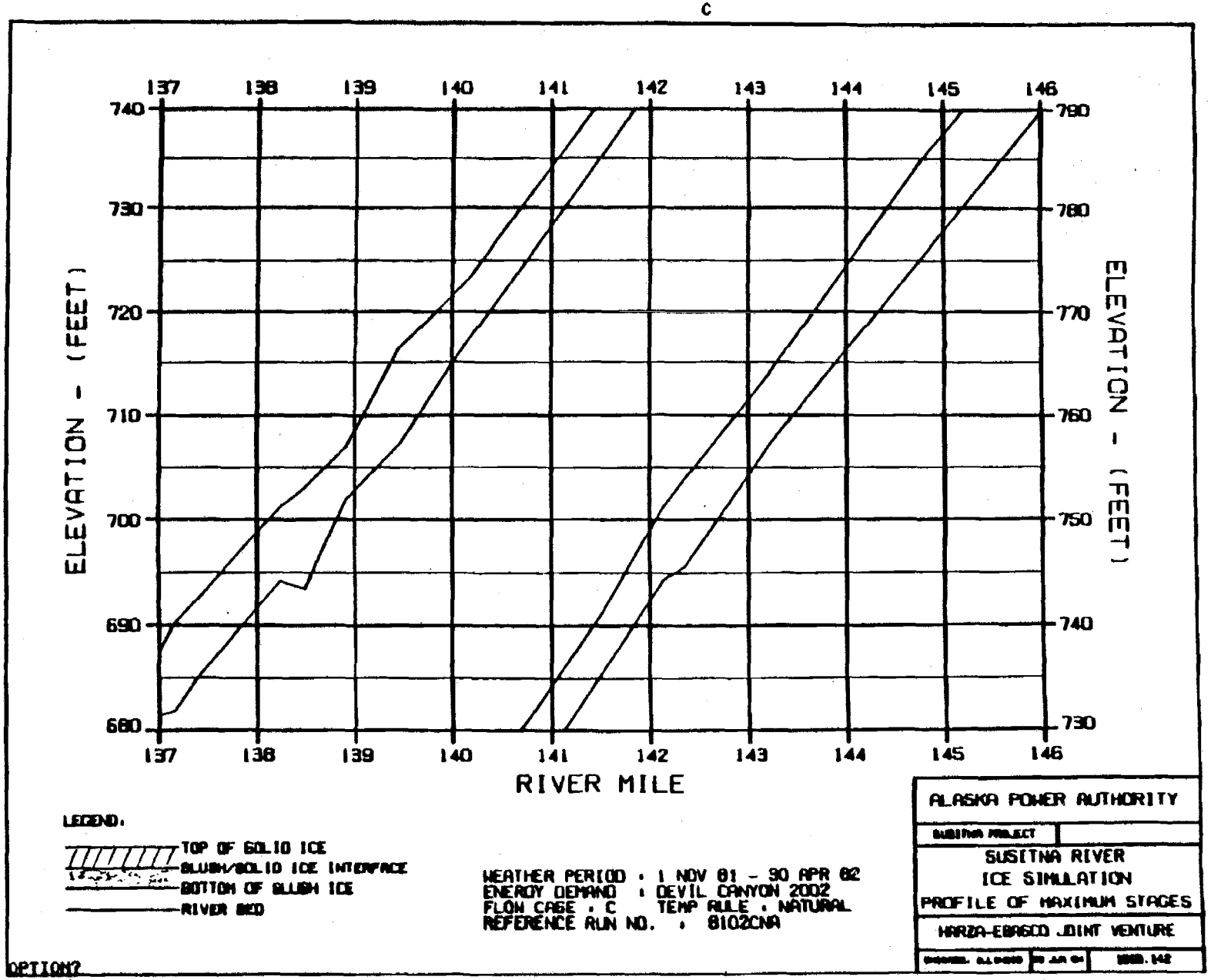
SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
PROFILE OF MAXIMUM STAGES

HARZA-EBASCO JOINT VENTURE

OPTION?

C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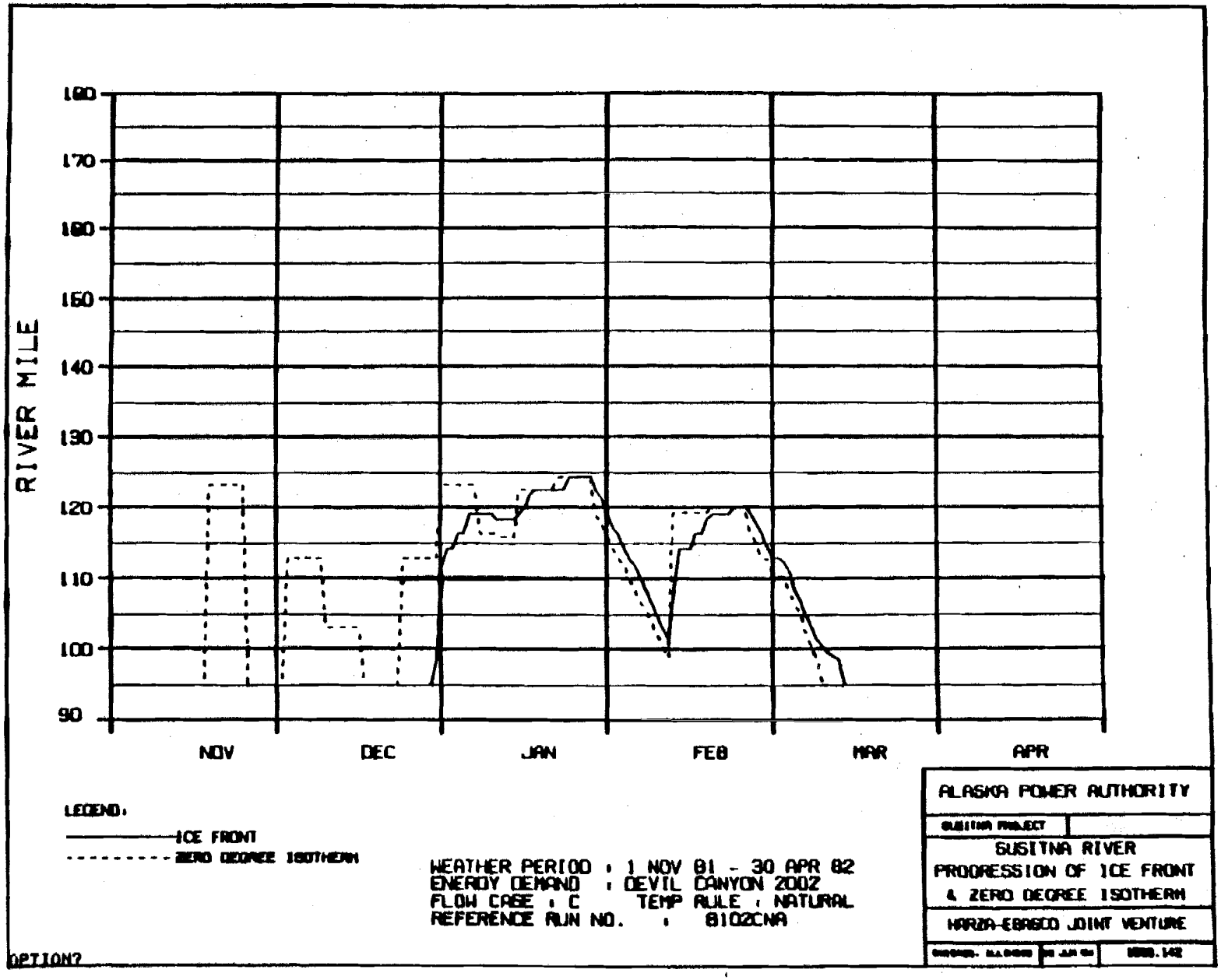
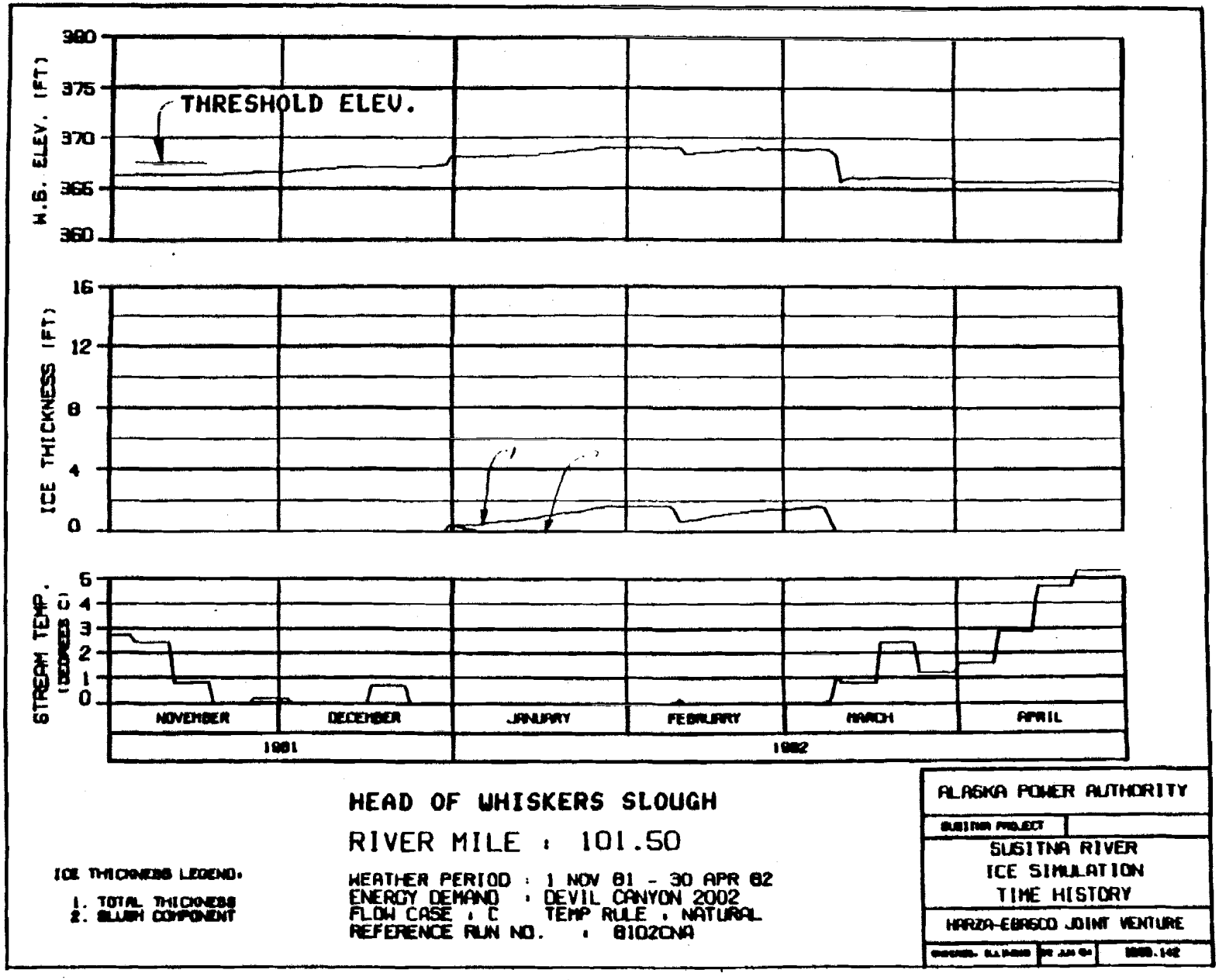
146
740
730
720
710
700
690
680
790
780
770
760
750
740
730
ELEVATION - (FEET)
ELEVATION - (FEET)
RIVER MILE
LEGEND:
TOP OF SOLID ICE
SLUSH/SOLID ICE INTERFACE
BOTTOM OF SLUSH ICE
RIVER BED
WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE : C TEMP RULE : NATURAL
REFERENCE RUN NO. : 8102CNA
ALASKA POWER AUTHORITY
SUSITNA PROJECT
SUSITNA RIVER
ICE SIMULATION
PROFILE OF MAXIMUM STAGES
HARZA-EBASCO JOINT VENTURE

OPTION?


RIVER MILE
180
170
160
150
140
130
120
110
100
90
NOV
DEC
JAN
FEB
MAR
APR
LEGEND:
ICE FRONT
ZERO DEGREE ISOTHERM
WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE : C TEMP RULE : NATURAL
REFERENCE RUN NO. : 8102CNA
ALASKA POWER AUTHORITY
SUSITNA PROJECT
SUSITNA RIVER
PROGRESSION OF ICE FRONT
& ZERO DEGREE ISOTHERM
HARZA-EBASCO JOINT VENTURE
OPTION?



HEAD OF WHISKERS SLOUGH

RIVER MILE : 101.50

ICE THICKNESS LEGEND:

1. TOTAL THICKNESS
2. SLUSH COMPONENT

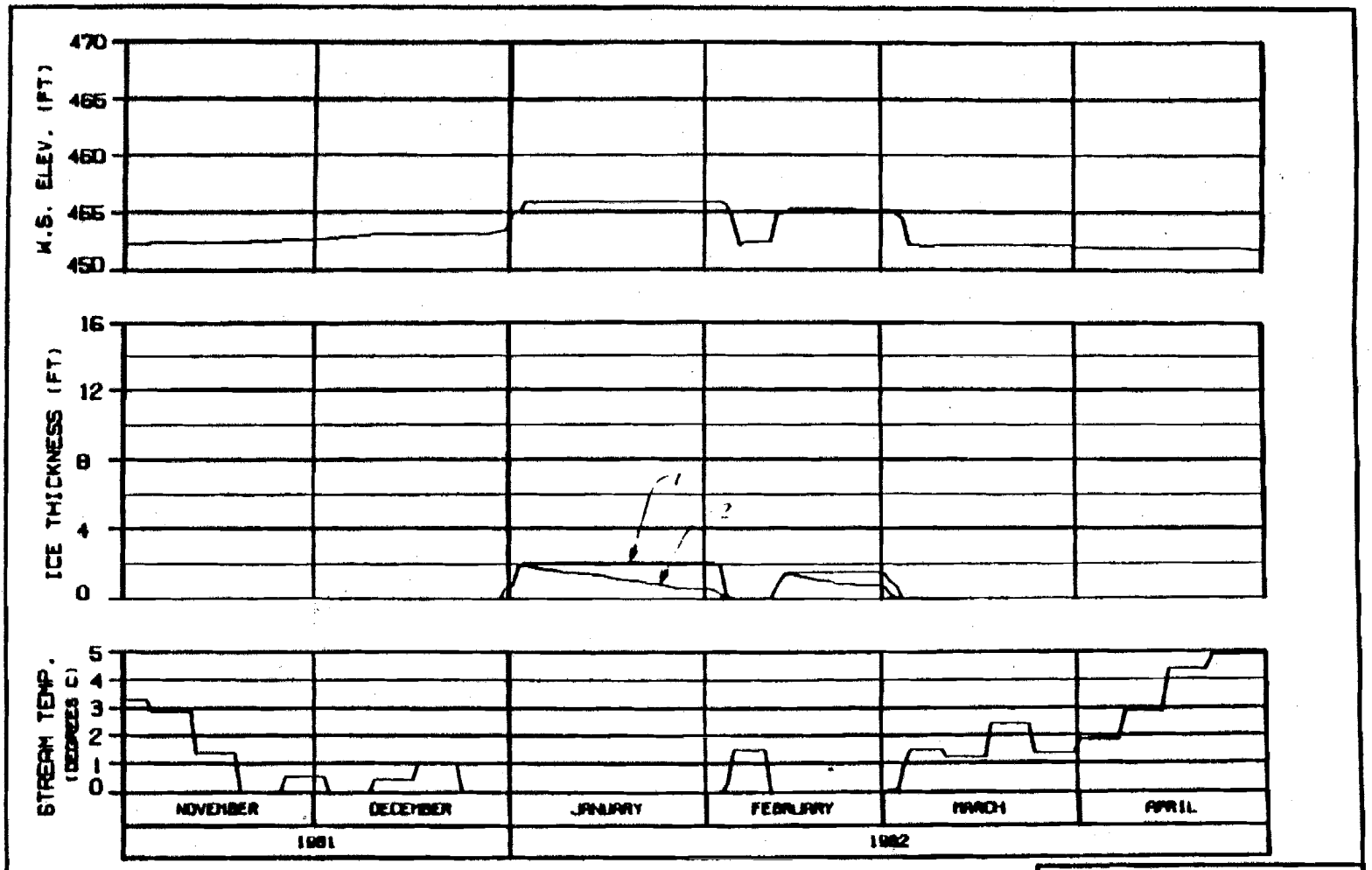
WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE : C TEMP RULE : NATURAL
REFERENCE RUN NO. : 8102CNA

ALASKA POWER AUTHORITY

SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE



SIDE CHANNEL AT HEAD OF GASH CREEK

RIVER MILE : 112.00

ICE THICKNESS LEGEND:

1. TOTAL THICKNESS
2. SLUSH COMPONENT

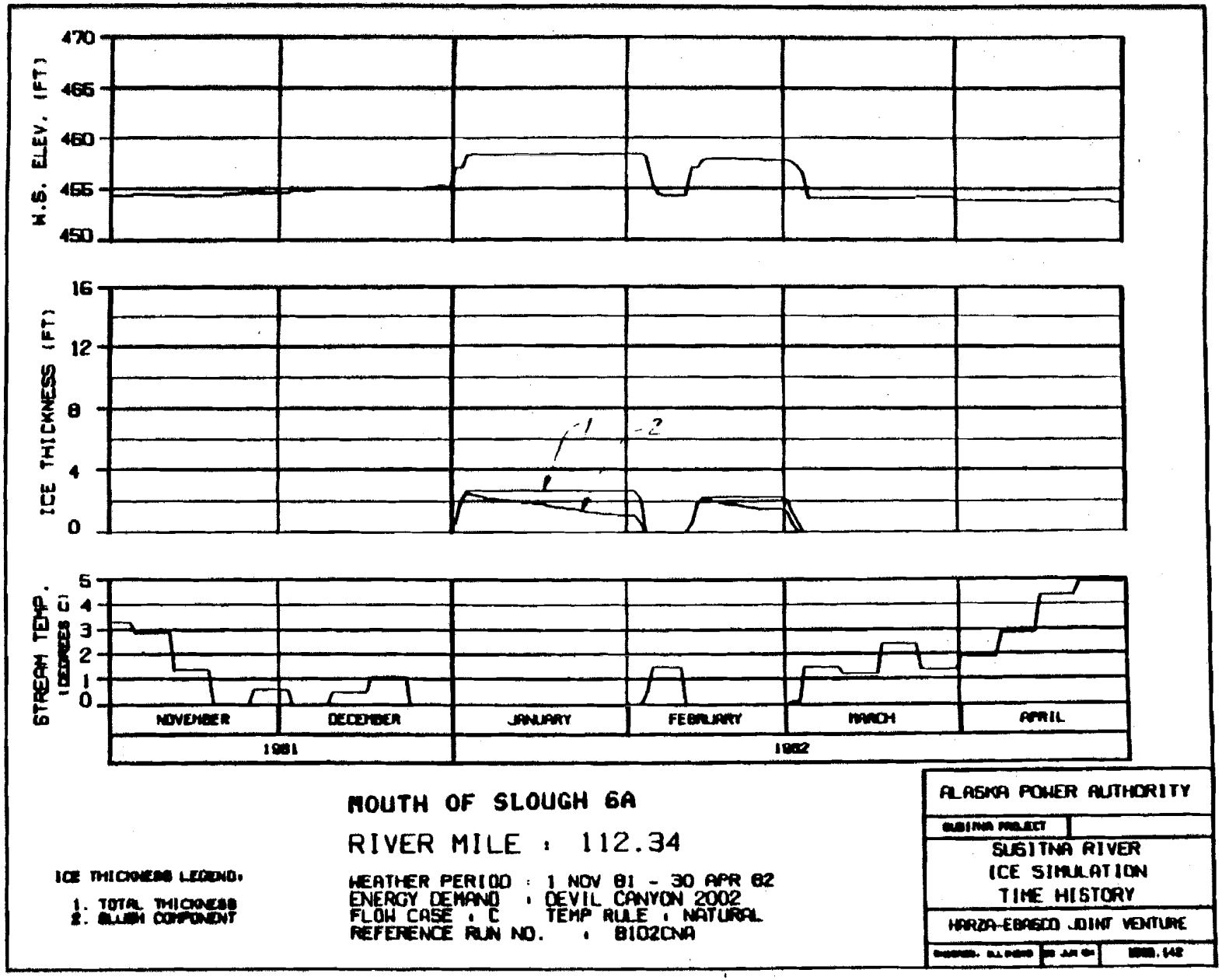
WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE : C TEMP RULE : NATURAL
REFERENCE RUN NO. : 8102CNA

ALASKA POWER AUTHORITY

SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE



MOUTH OF SLOUGH 6A

RIVER MILE : 112.34

ICE THICKNESS LEGEND:

1. TOTAL THICKNESS
2. SLUSH COMPONENT

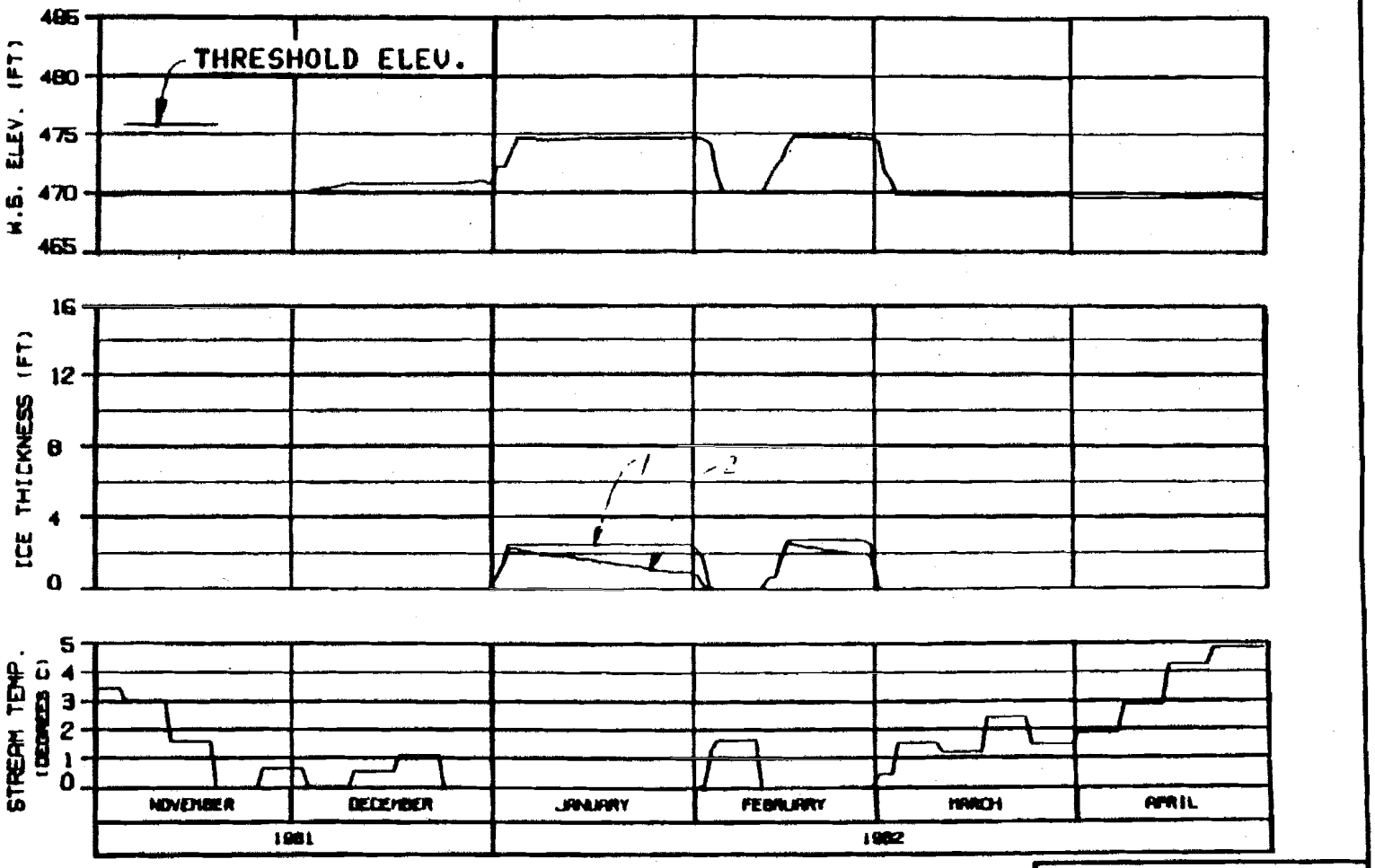
WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE : C TEMP RULE : NATURAL
REFERENCE RUN NO. : 8102CNA

ALASKA POWER AUTHORITY

SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE



HEAD OF SLOUGH 8

RIVER MILE : 114.10

ICE THICKNESS LEGEND:

1. TOTAL THICKNESS
2. SLUSH COMPONENT

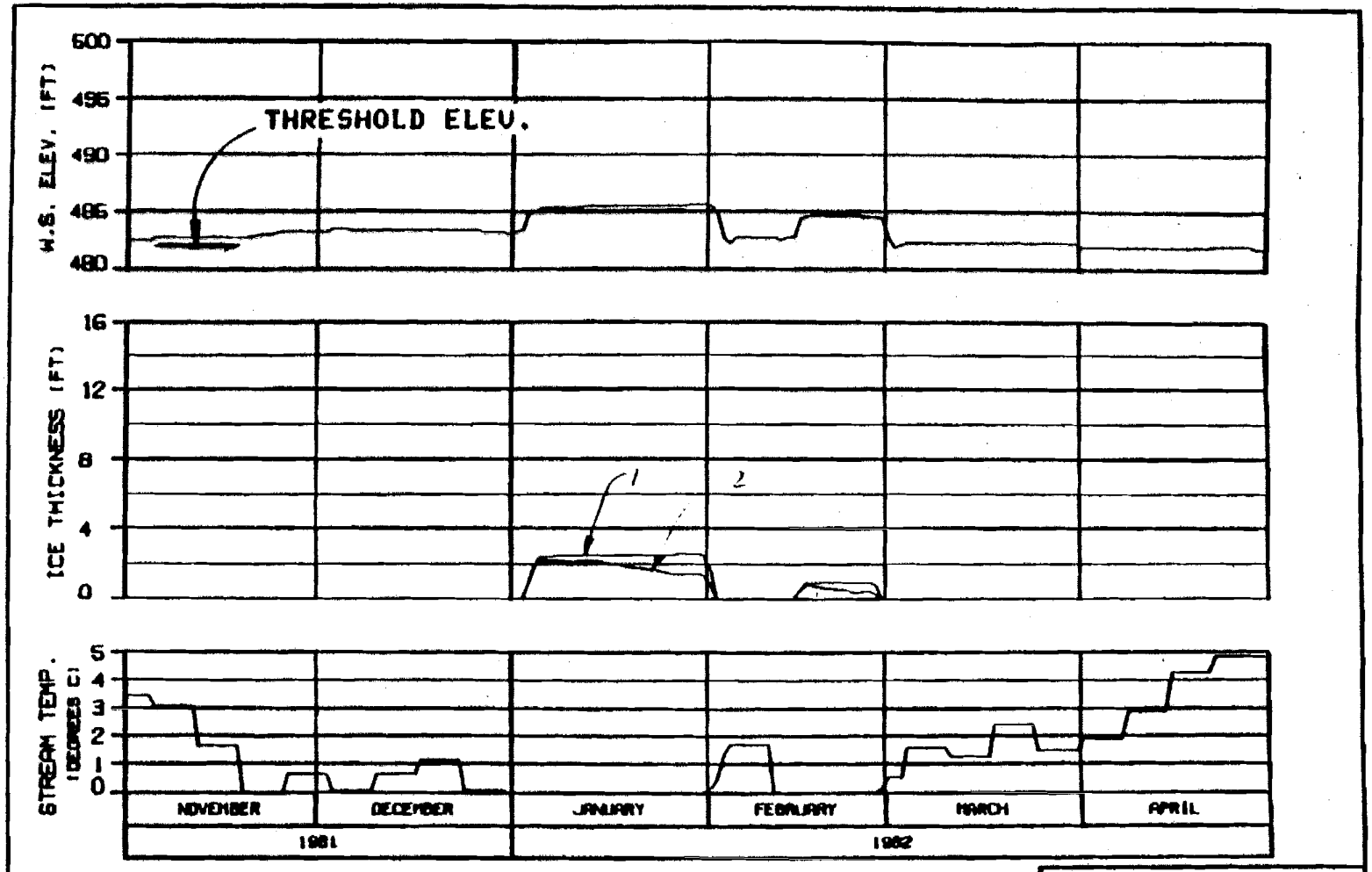
WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE : C TEMP RULE : NATURAL
REFERENCE RUN NO. : 8102CNA

ALASKA POWER AUTHORITY

SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE



SIDE CHANNEL MSII

RIVER MILE : 115.50

ICE THICKNESS LEGEND:

1. TOTAL THICKNESS
2. SLUSH COMPONENT

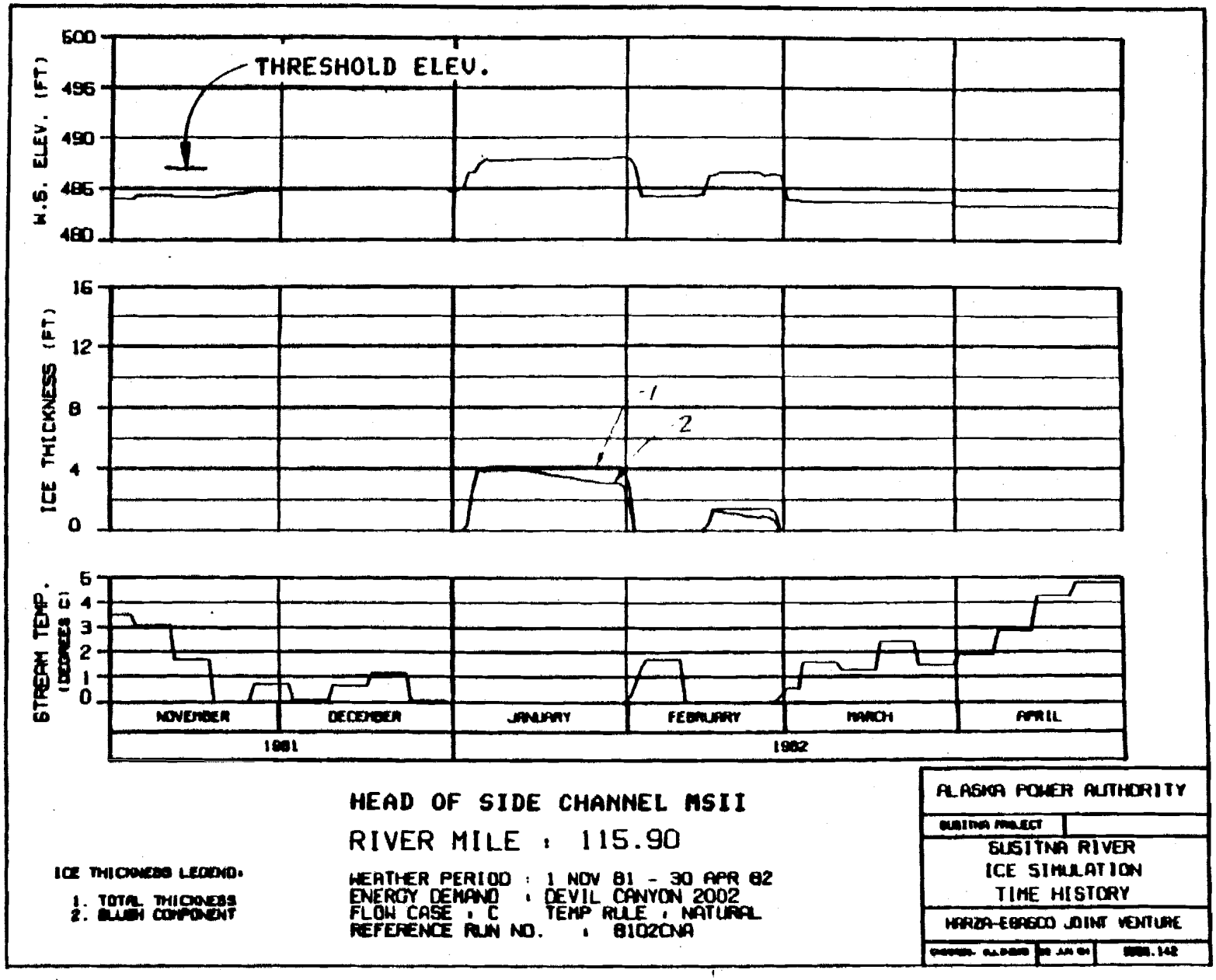
WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE : C TEMP RULE : NATURAL
REFERENCE RUN NO. : 8102CNA

ALASKA POWER AUTHORITY

SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE



HEAD OF SIDE CHANNEL MSII

RIVER MILE : 115.90

ICE THICKNESS LEGEND:

1. TOTAL THICKNESS
2. SLUSH COMPONENT

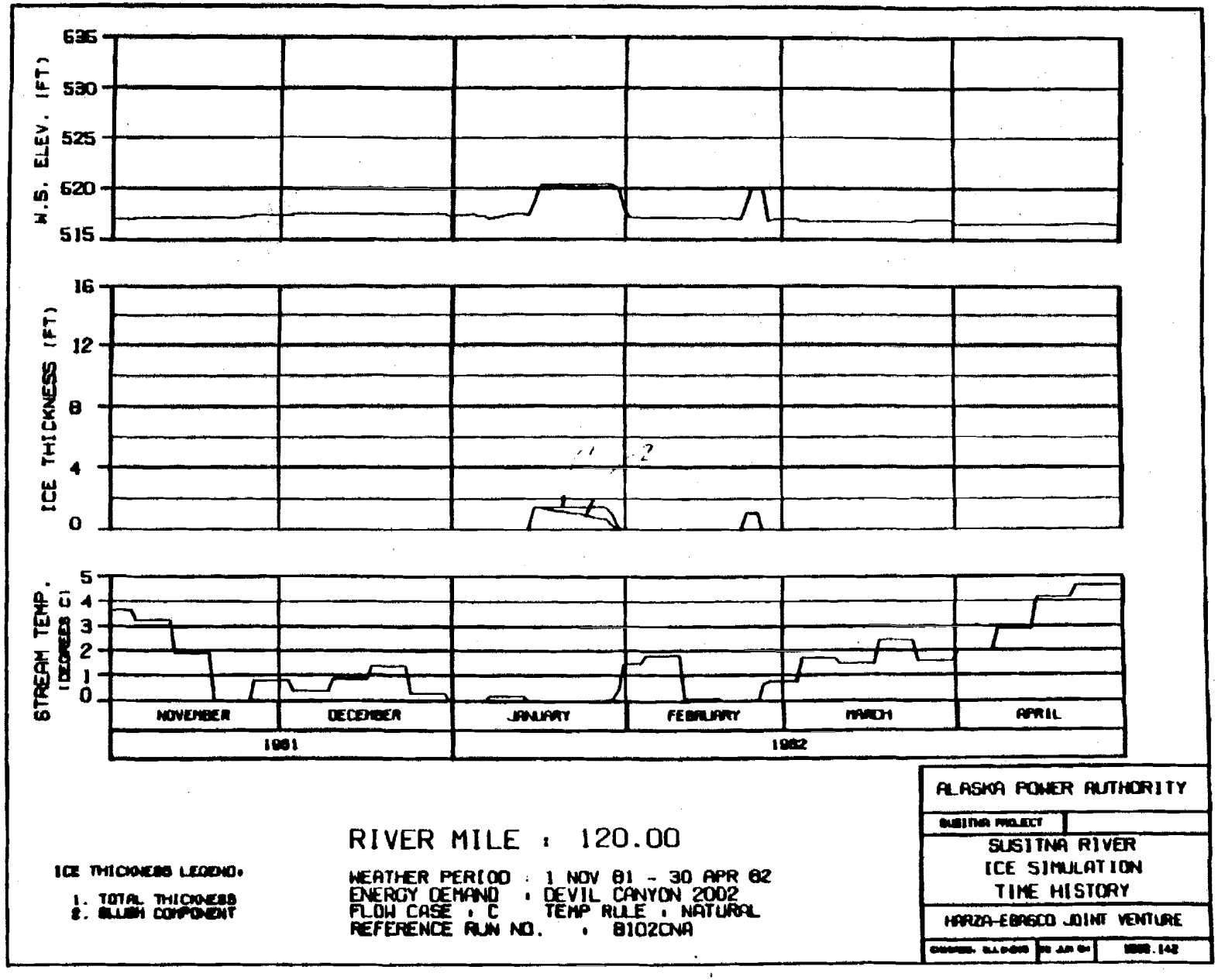
WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE : C TEMP RULE : NATURAL
REFERENCE RUN NO. : 8102CNA

ALASKA POWER AUTHORITY

SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE



RIVER MILE : 120.00

ICE THICKNESS LEGEND:

1. TOTAL THICKNESS
2. SLUSH COMPONENT

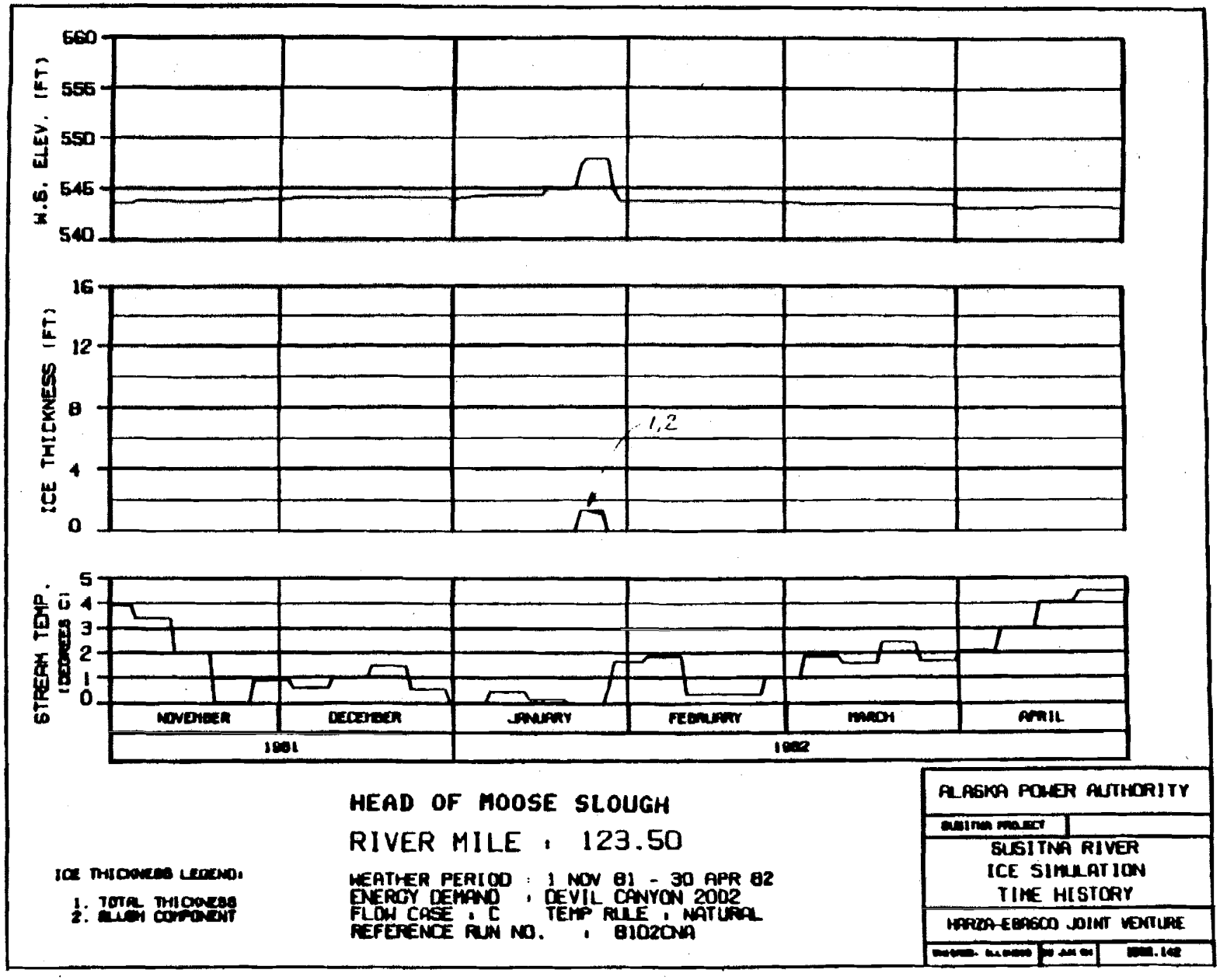
WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE : C TEMP RULE : NATURAL
REFERENCE RUN NO. : B102CNA

ALASKA POWER AUTHORITY

SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE



HEAD OF MOOSE SLOUGH

RIVER MILE : 123.50

ICE THICKNESS LEGEND:

1. TOTAL THICKNESS
2. SLUSH COMPONENT

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE : C TEMP RULE : NATURAL
REFERENCE RUN NO. : 8102CNA

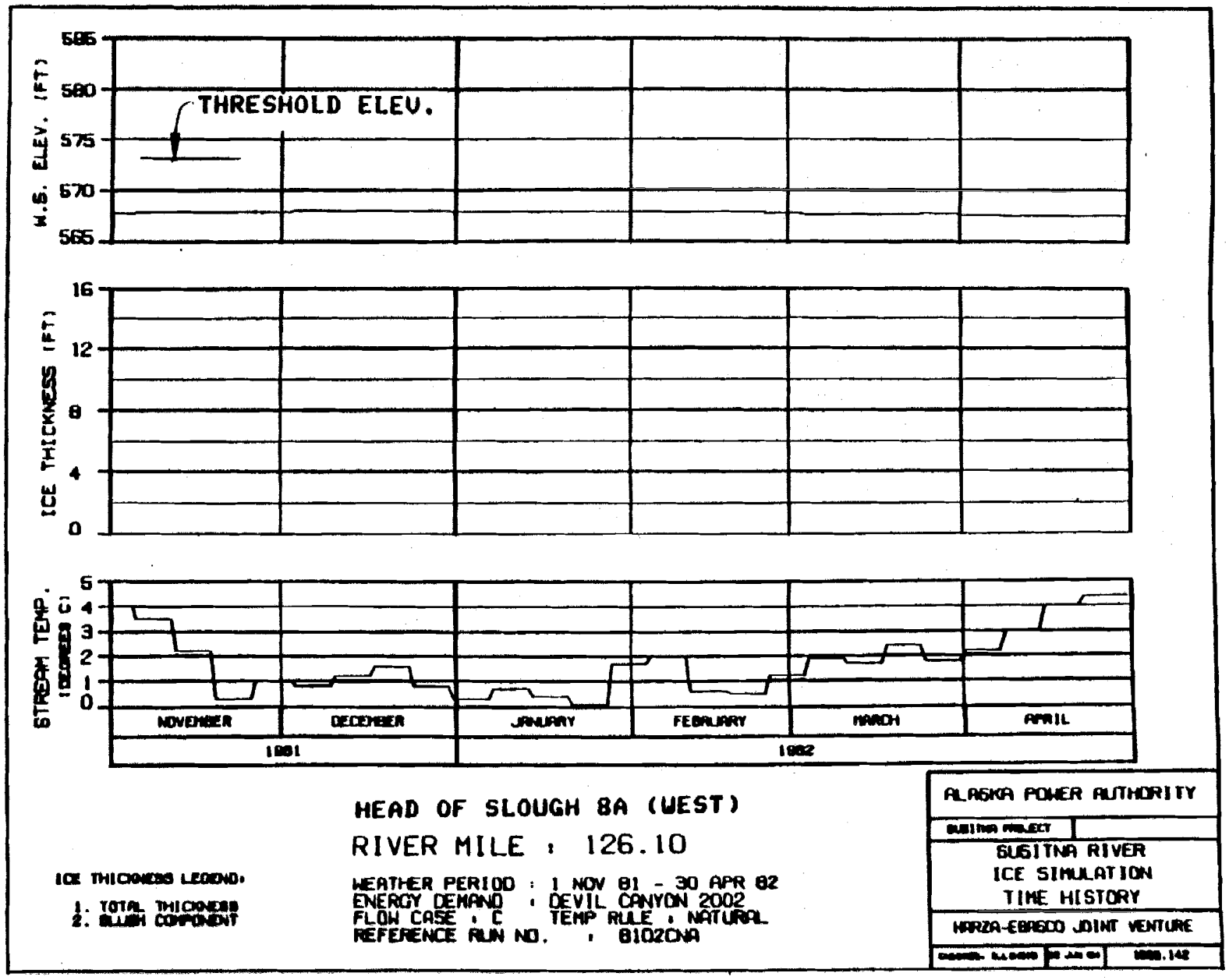
ALASKA POWER AUTHORITY

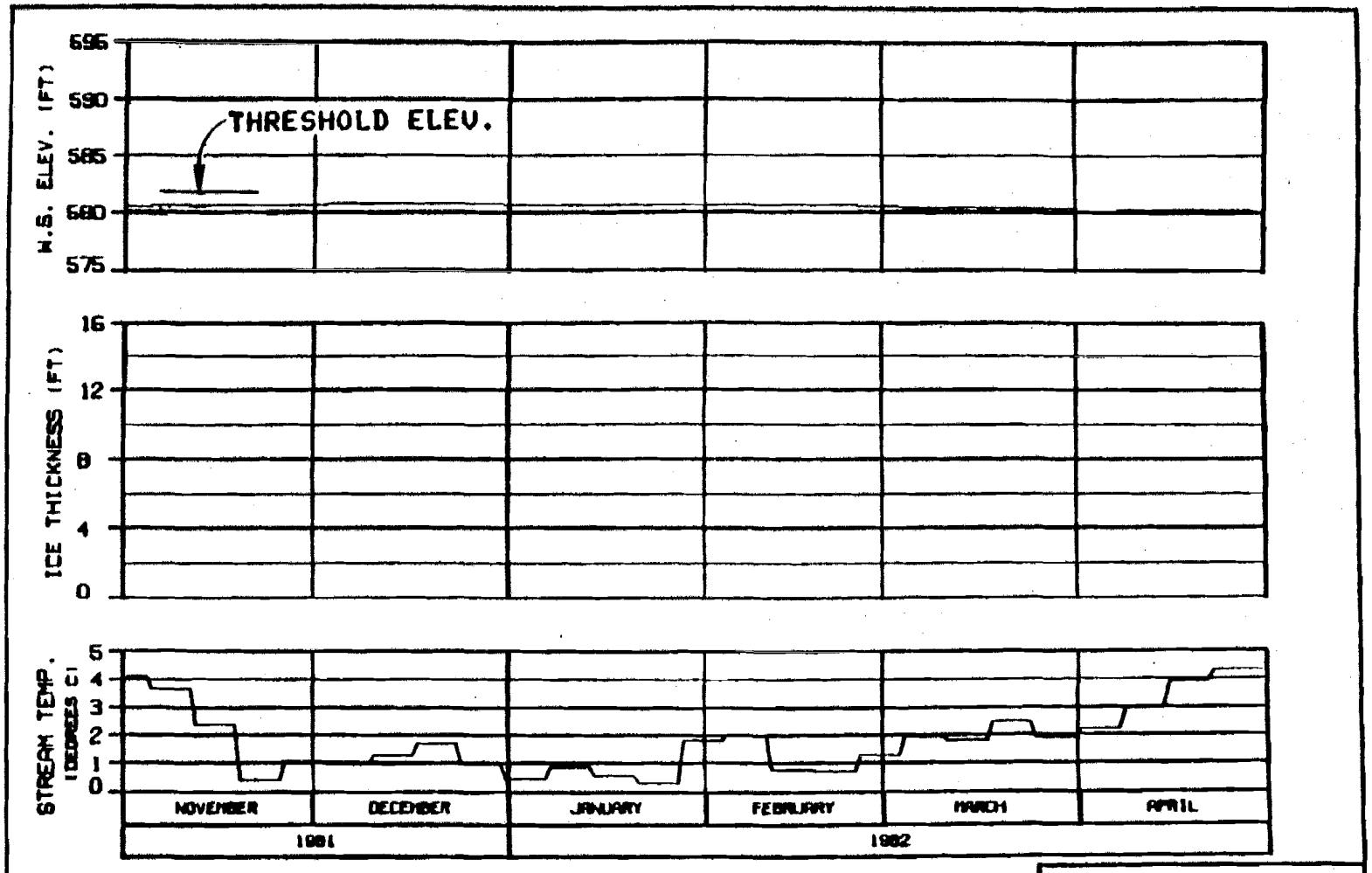
SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE

JUN 84 | 8808.142


W.S. ELEV. (FT)
585
580
575
570
565
THRESHOLD ELEV.
ICE THICKNESS (FT)
16
12
8
4
0
STREAM TEMP. (DEGREES C)
5
4
3
2
1
0
NOVEMBER
DECEMBER
JANUARY
FEBRUARY
MARCH
APRIL
1981
1982
HEAD OF SLOUGH 8A (WEST)
RIVER MILE : 126.10
ICE THICKNESS LEGEND:
1. TOTAL THICKNESS
2. SLUSH COMPONENT
WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE : C TEMP RULE : NATURAL
REFERENCE RUN NO. : 8102CNA
ALASKA POWER AUTHORITY
SUSITNA PROJECT
SUSITNA RIVER
ICE SIMULATION
TIME HISTORY
HARZA-EBASCO JOINT VENTURE



HEAD OF SLOUGH 8A (EAST)

RIVER MILE : 127.10

ICE THICKNESS LEGEND:

1. TOTAL THICKNESS
2. SLUSH COMPONENT

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE : C TEMP RULE : NATURAL
REFERENCE RUN NO. : B102CNA

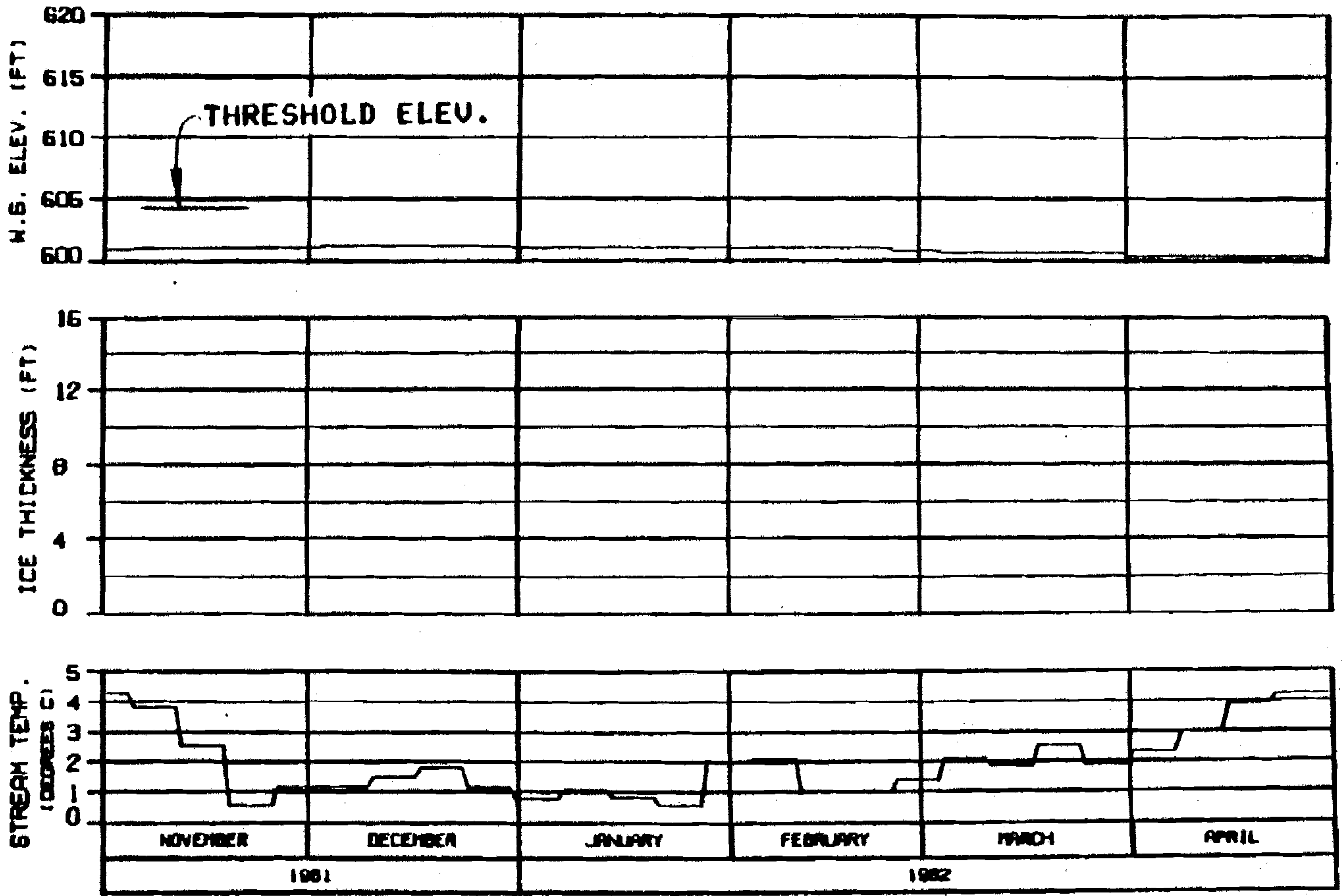
ALASKA POWER AUTHORITY

SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE

STOP C



HEAD OF SLOUGH 9

RIVER MILE : 129.30

ICE THICKNESS LEGEND:

1. TOTAL THICKNESS
2. SLUSH COMPONENT

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE : C TEMP RULE : NATURAL
REFERENCE RUN NO. : 8102CNA

ALASKA POWER AUTHORITY

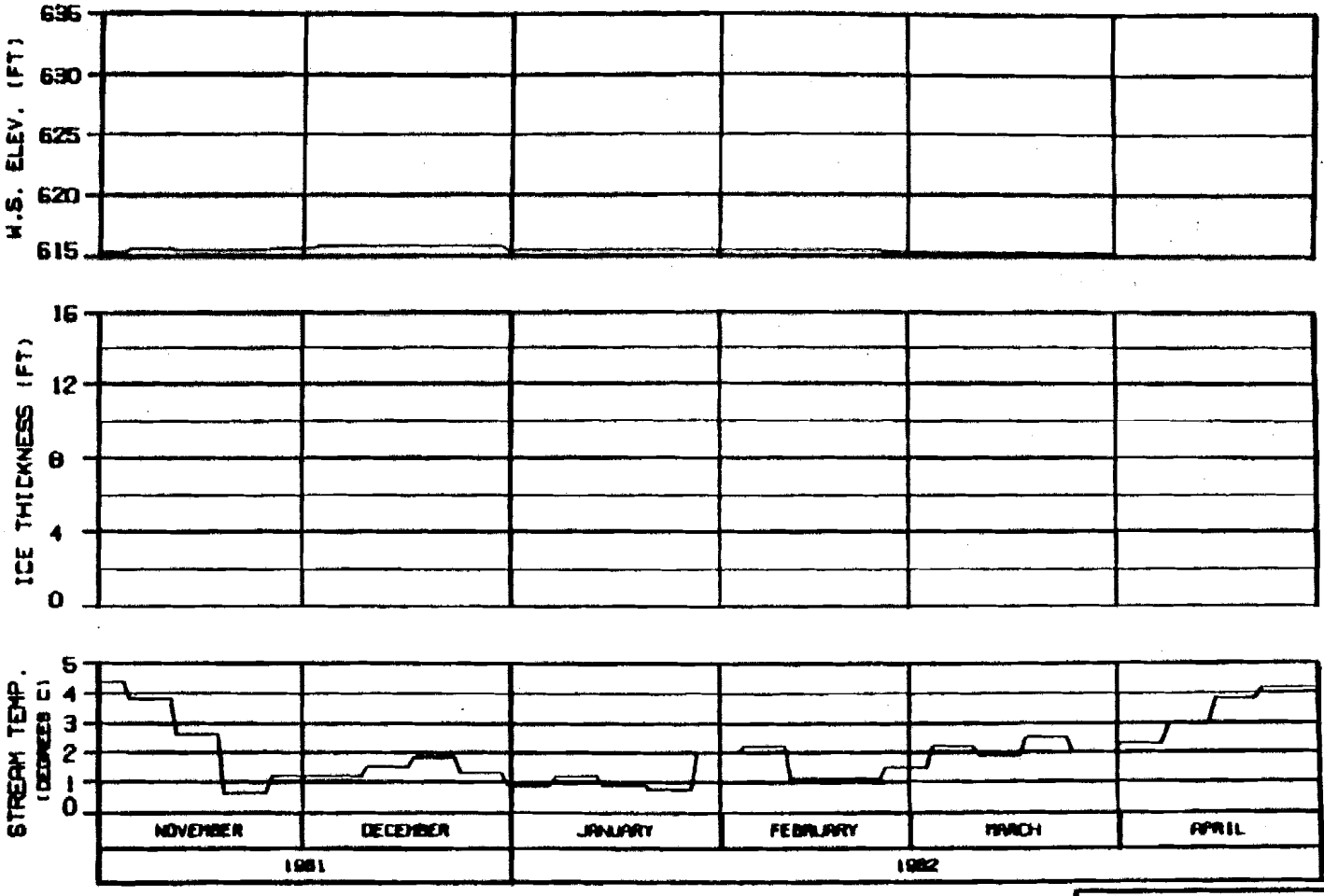
SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE

OPTION?

OPTION?



SIDE CHANNEL U/S OF SLOUGH 9

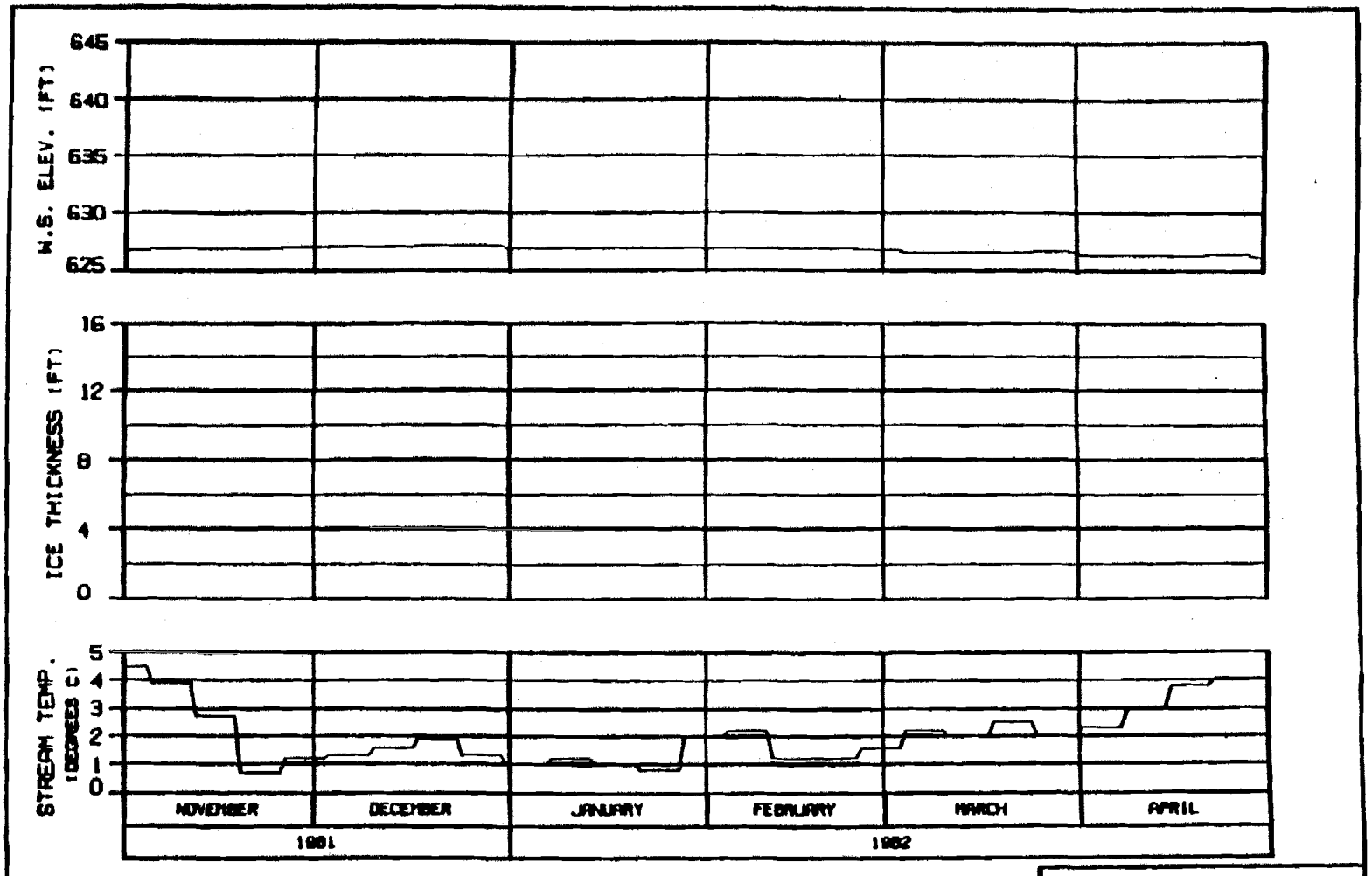
RIVER MILE : 130.60

ICE THICKNESS LEGEND:

1. TOTAL THICKNESS
2. BLUSH COMPONENT

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE : C TEMP RULE : NATURAL
REFERENCE RUN NO. : 8102CNA

ALASKA POWER AUTHORITY
SUSITNA PROJECT
SUSITNA RIVER
ICE SIMULATION
TIME HISTORY
HARZA-EBASCO JOINT VENTURE



SIDE CHANNEL U/S OF 4TH JULY CREEK

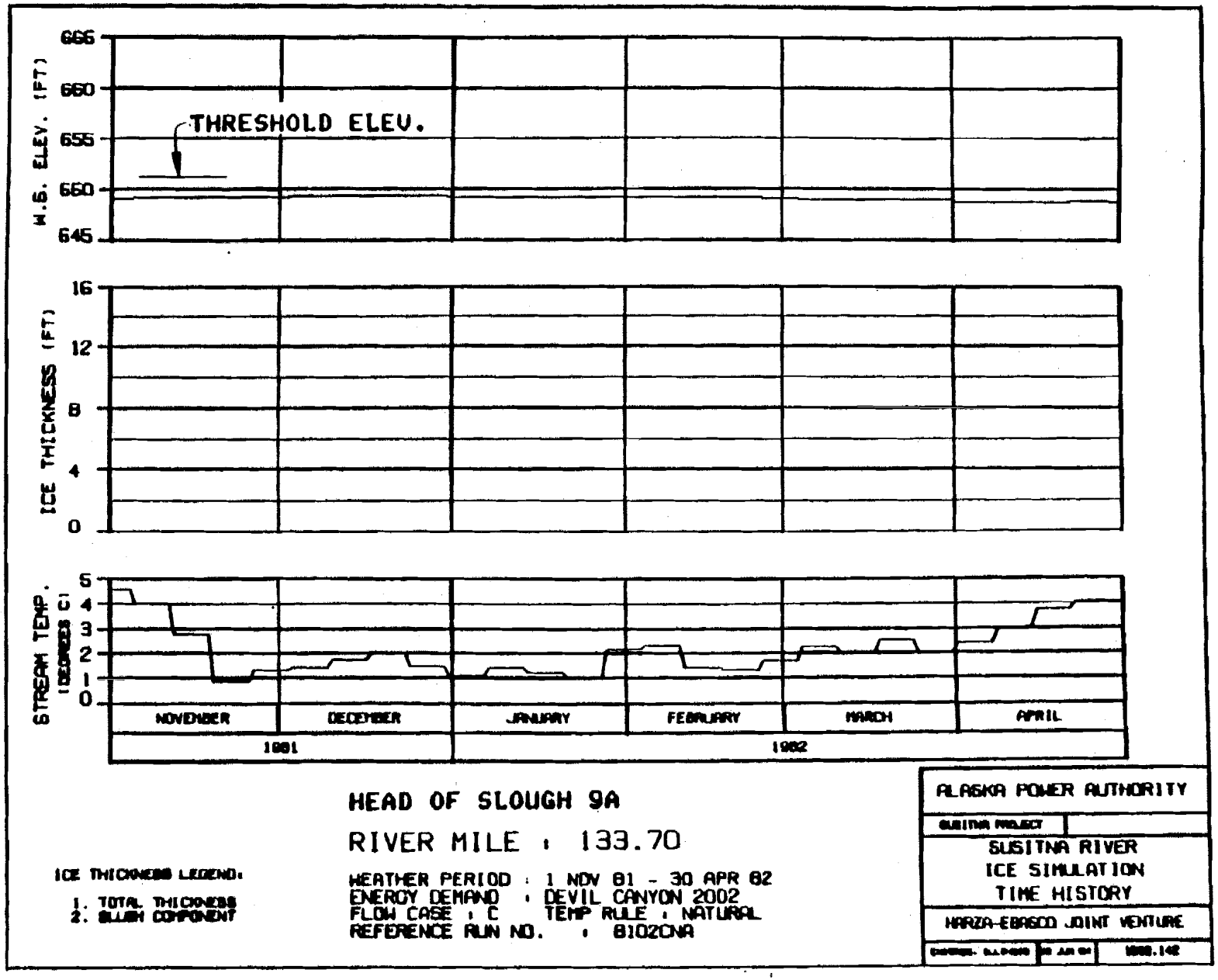
RIVER MILE : 131.80

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE : C TEMP RULE : NATURAL
REFERENCE RUN NO. : 8102CNA

ICE THICKNESS LEGEND:

1. TOTAL THICKNESS
2. SLUSH COMPONENT

ALASKA POWER AUTHORITY
SUSITNA PROJECT
SUSITNA RIVER ICE SIMULATION TIME HISTORY
HARZA-EBASCO JOINT VENTURE
[illegible]



HEAD OF SLOUGH 9A

RIVER MILE : 133.70

ICE THICKNESS LEGEND:

1. TOTAL THICKNESS
2. SLUSH COMPONENT

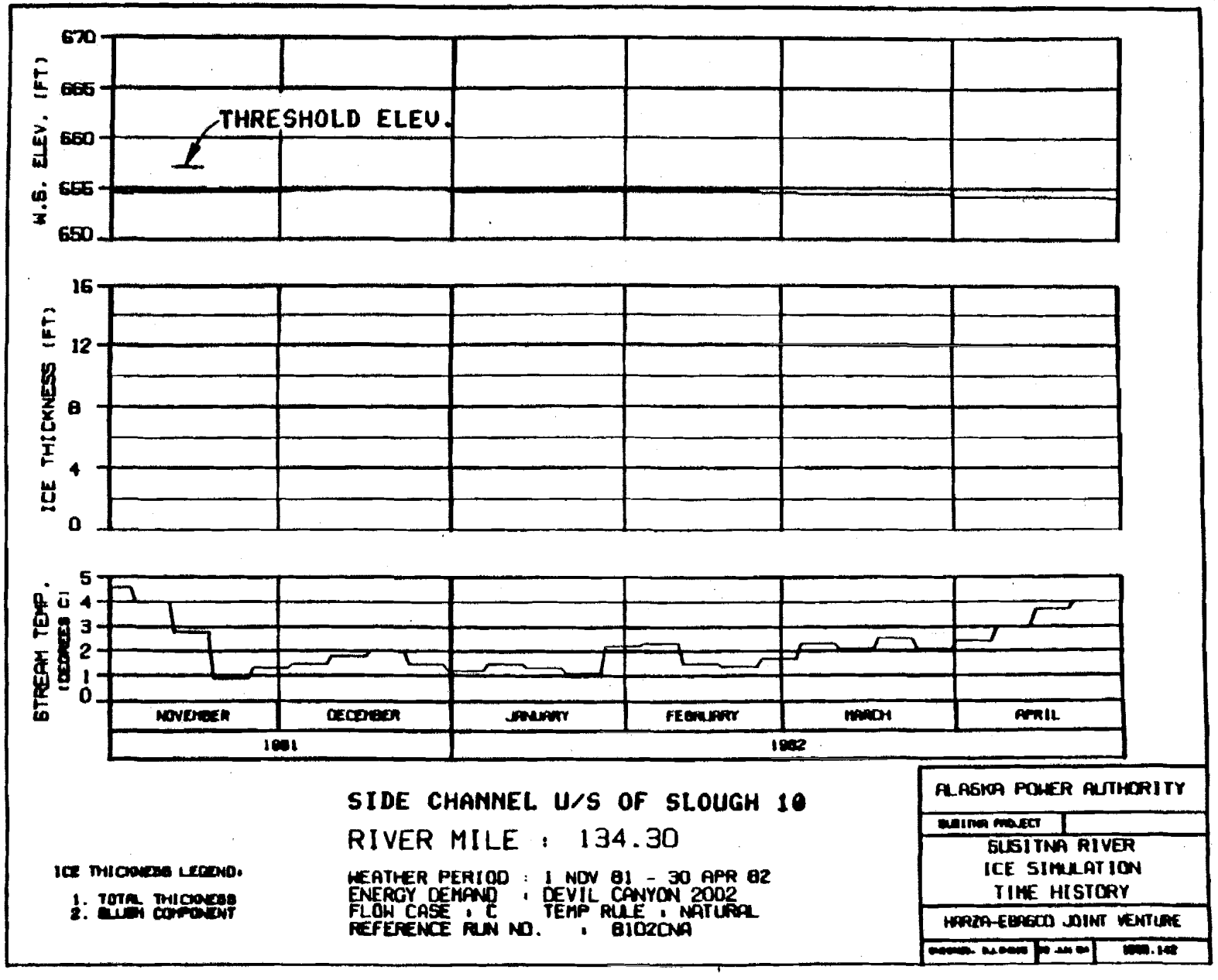
WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE : C TEMP RULE : NATURAL
REFERENCE RUN NO. : 8102CNA

ALASKA POWER AUTHORITY

SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE



SIDE CHANNEL U/S OF SLOUGH 10

RIVER MILE : 134.30

ICE THICKNESS LEGEND:

1. TOTAL THICKNESS
2. SLUSH COMPONENT

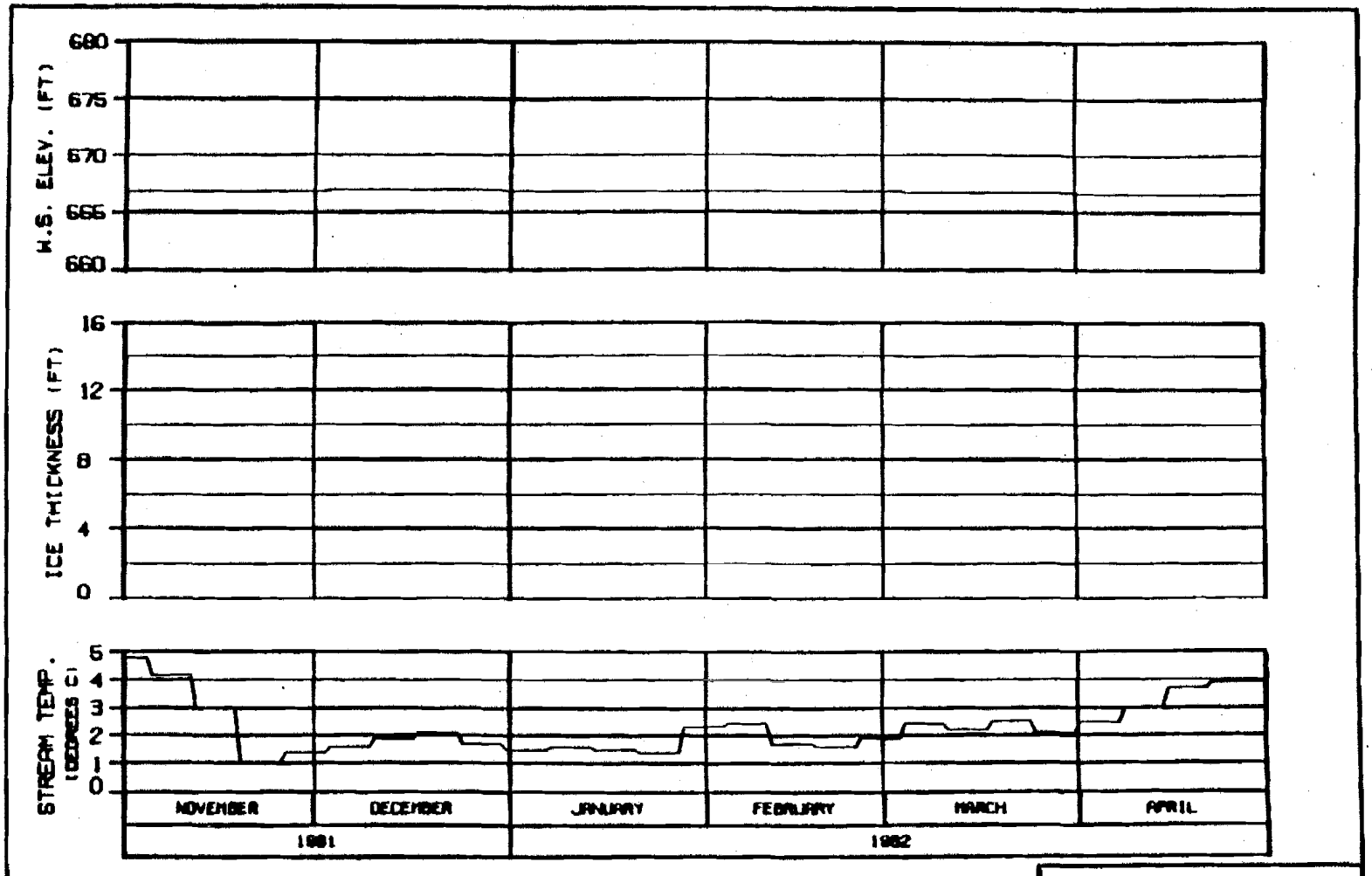
WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE : C TEMP RULE : NATURAL
REFERENCE RUN NO. : B102CNA

ALASKA POWER AUTHORITY

SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE



SIDE CHANNEL D/S OF SLOUGH 11

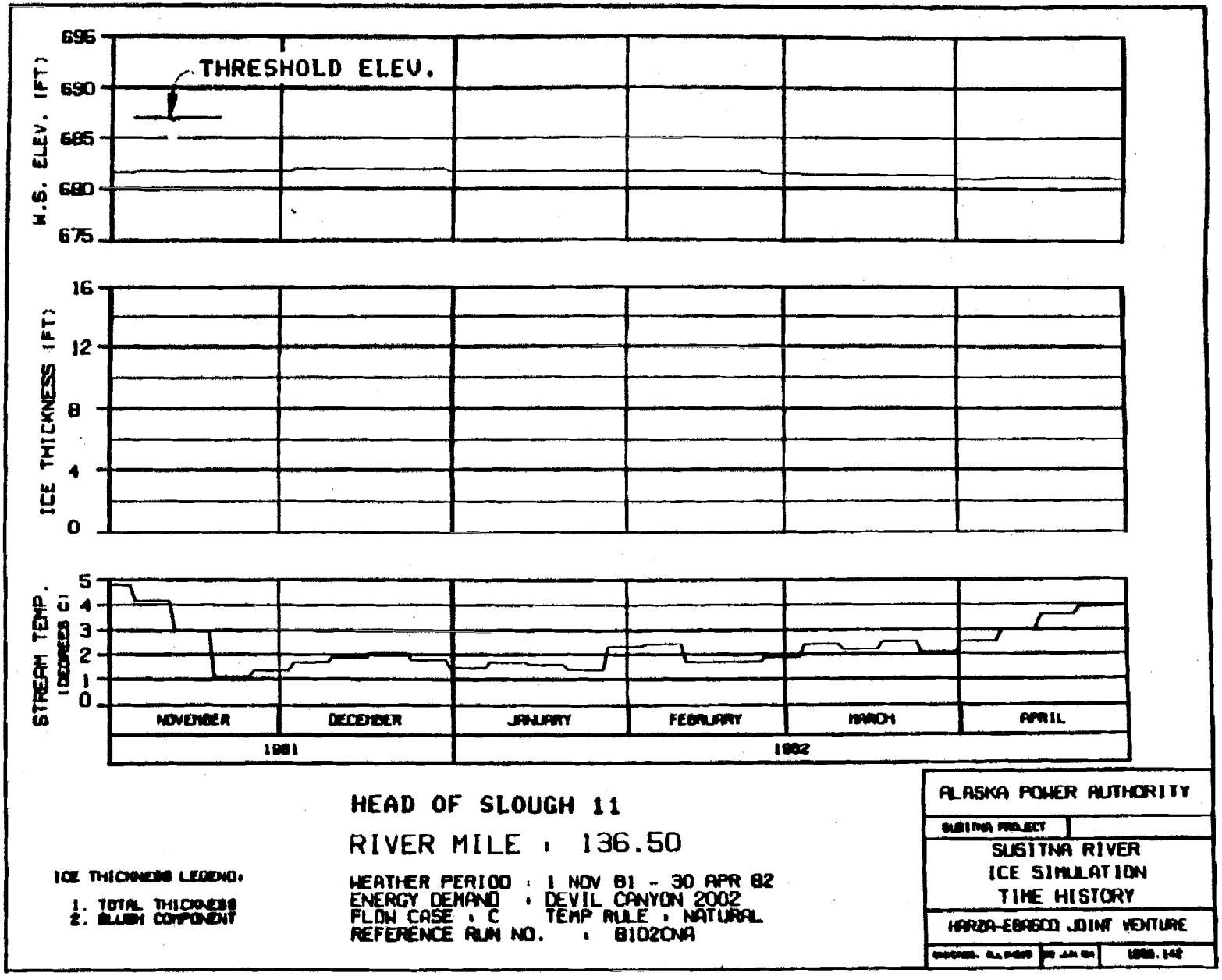
RIVER MILE : 135.30

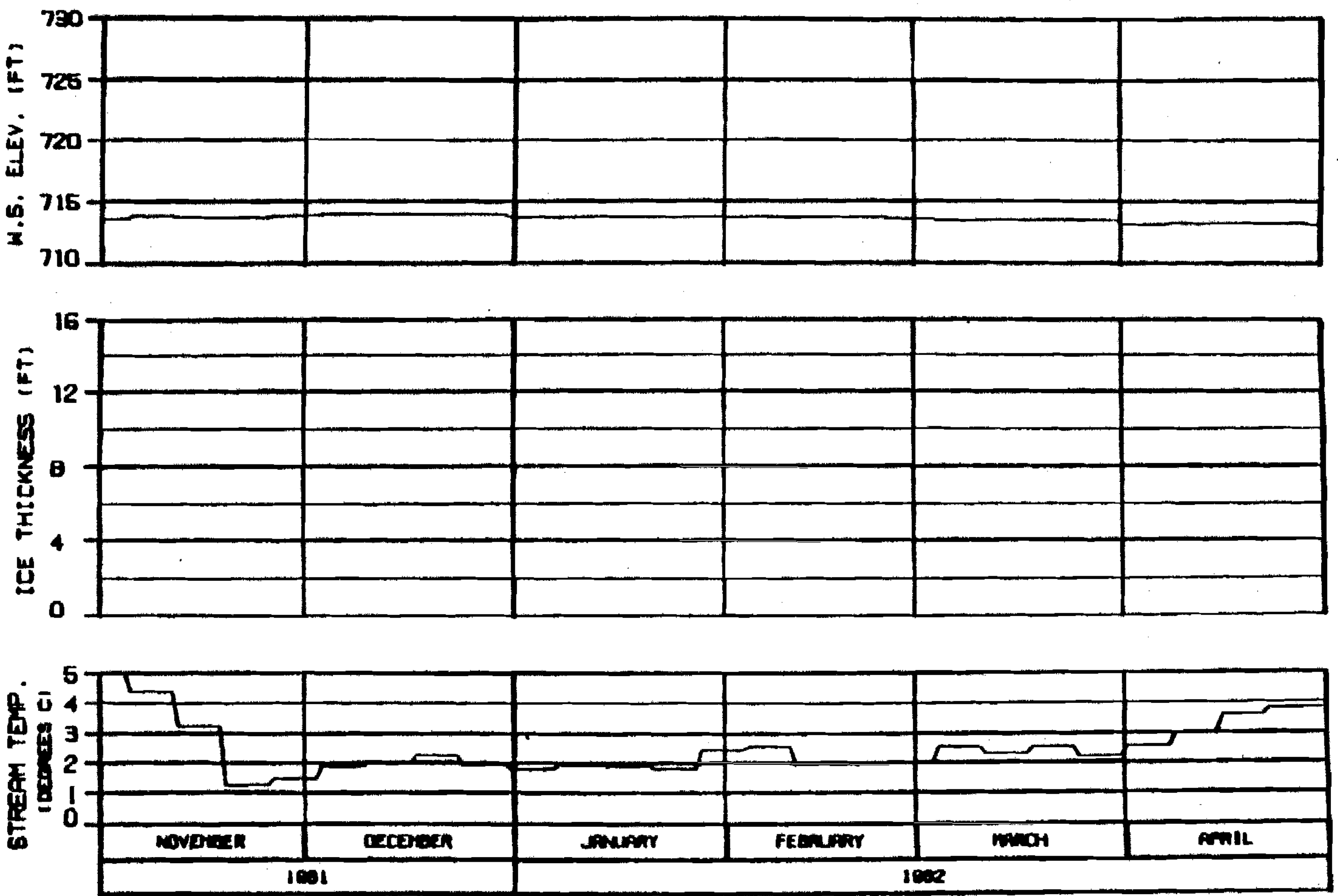
WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE : C TEMP RULE : NATURAL
REFERENCE RUN NO. : 8102CNA

ICE THICKNESS LEGEND:

1. TOTAL THICKNESS
2. SLUSH COMPONENT

ALASKA POWER AUTHORITY
SUSITNA PROJECT
SUSITNA RIVER
ICE SIMULATION
TIME HISTORY
HARZA-EBASCO JOINT VENTURE


W.S. ELEV. (FT)
695
690
685
680
675
THRESHOLD ELEV.
ICE THICKNESS (FT)
16
12
8
4
0
STREAM TEMP. (DEGREES C)
5
4
3
2
1
0
NOVEMBER
DECEMBER
JANUARY
FEBRUARY
MARCH
APRIL
1981
1982
HEAD OF SLOUGH 11
RIVER MILE : 136.50
ICE THICKNESS LEGEND:
1. TOTAL THICKNESS
2. SLUSH COMPONENT
WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE : C TEMP RULE : NATURAL
REFERENCE RUN NO. : B102CNA
ALASKA POWER AUTHORITY
SUSITNA PROJECT
SUSITNA RIVER
ICE SIMULATION
TIME HISTORY
HARZA-EBASCO JOINT VENTURE



HEAD OF SLOUGH 17

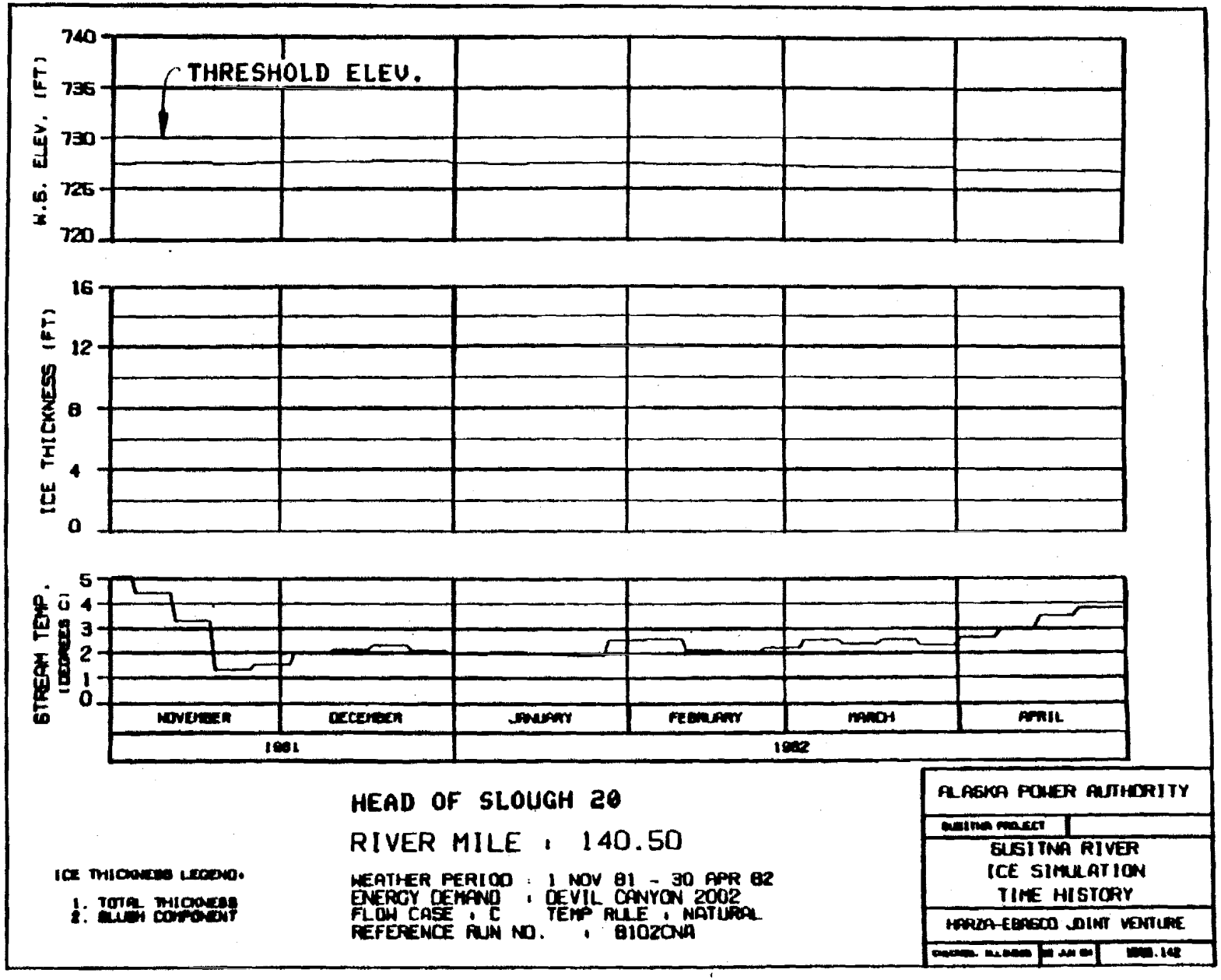
RIVER MILE : 139.30

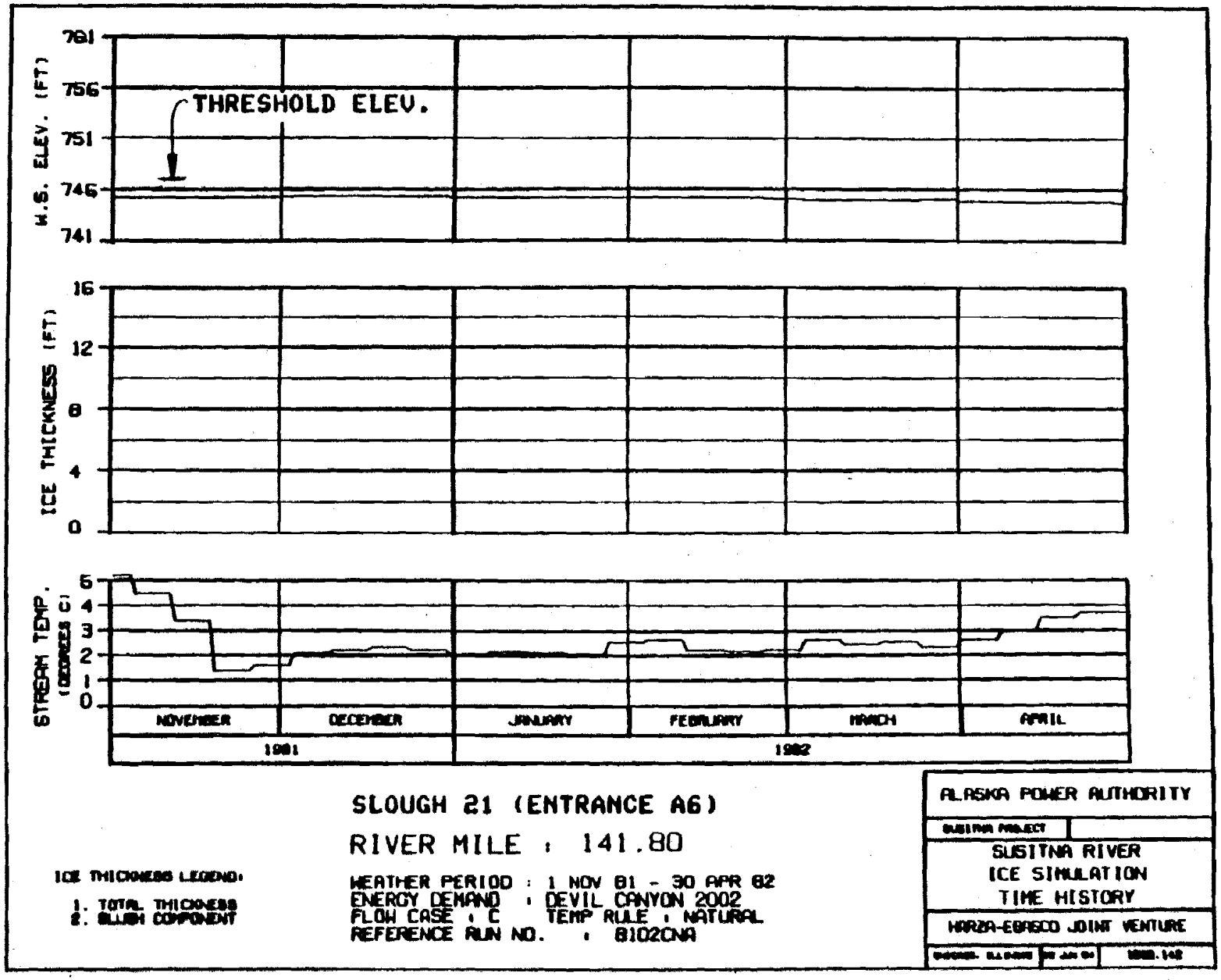
ICE THICKNESS LEGEND:

1. TOTAL THICKNESS
2. SLUSH COMPONENT

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE : C   TEMP RULE : NATURAL
REFERENCE RUN NO. : 8102CNA

ALASKA POWER AUTHORITY
SUSITNA PROJECT
SUSITNA RIVER ICE SIMULATION TIME HISTORY
HARZA-EBASCO JOINT VENTURE
[illegible]


W.S. ELEV. (FT)
740
735
730
725
720
THRESHOLD ELEV.
ICE THICKNESS (FT)
16
12
8
4
0
STREAM TEMP. (DEGREES C)
5
4
3
2
1
0
NOVEMBER
DECEMBER
JANUARY
FEBRUARY
MARCH
APRIL
1981
1982
HEAD OF SLOUGH 20
RIVER MILE : 140.50
ICE THICKNESS LEGEND:
1. TOTAL THICKNESS
2. SLUSH COMPONENT
WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE : C TEMP RULE : NATURAL
REFERENCE RUN NO. : 81020NA
ALASKA POWER AUTHORITY
SUSITNA PROJECT
SUSITNA RIVER
ICE SIMULATION
TIME HISTORY
HARZA-EBASCO JOINT VENTURE



SLOUGH 21 (ENTRANCE A6)

RIVER MILE : 141.80

ICE THICKNESS LEGEND:

1. TOTAL THICKNESS
2. SLUSH COMPONENT

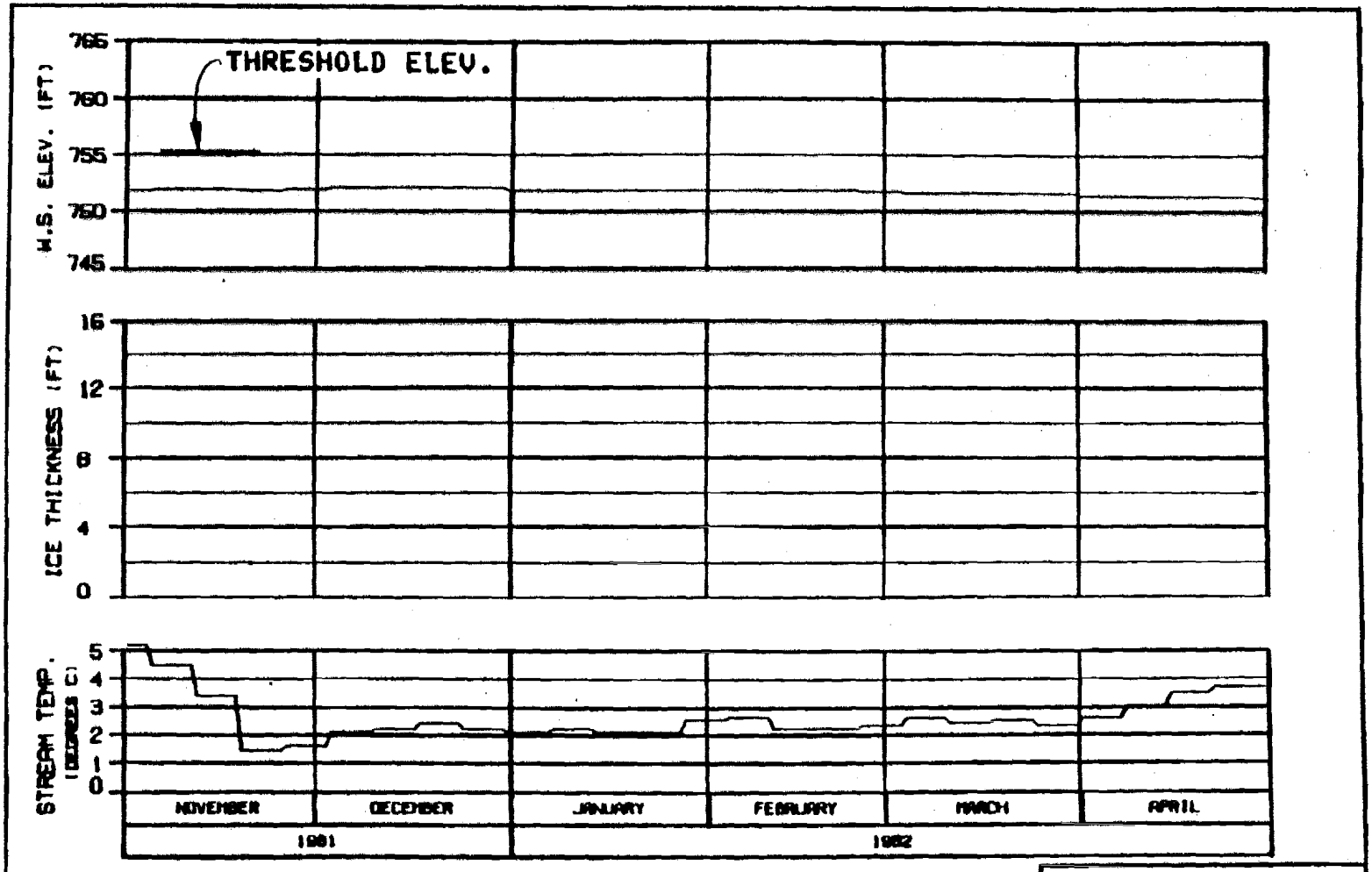
WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE : C TEMP RULE : NATURAL
REFERENCE RUN NO. : 8102CNA

ALASKA POWER AUTHORITY

SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE



HEAD OF SLOUGH 21

RIVER MILE : 142.20

ICE THICKNESS LEGEND:

1. TOTAL THICKNESS
2. SLUSH COMPONENT

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE : C TEMP RULE : NATURAL
REFERENCE RUN NO. : B102CNA

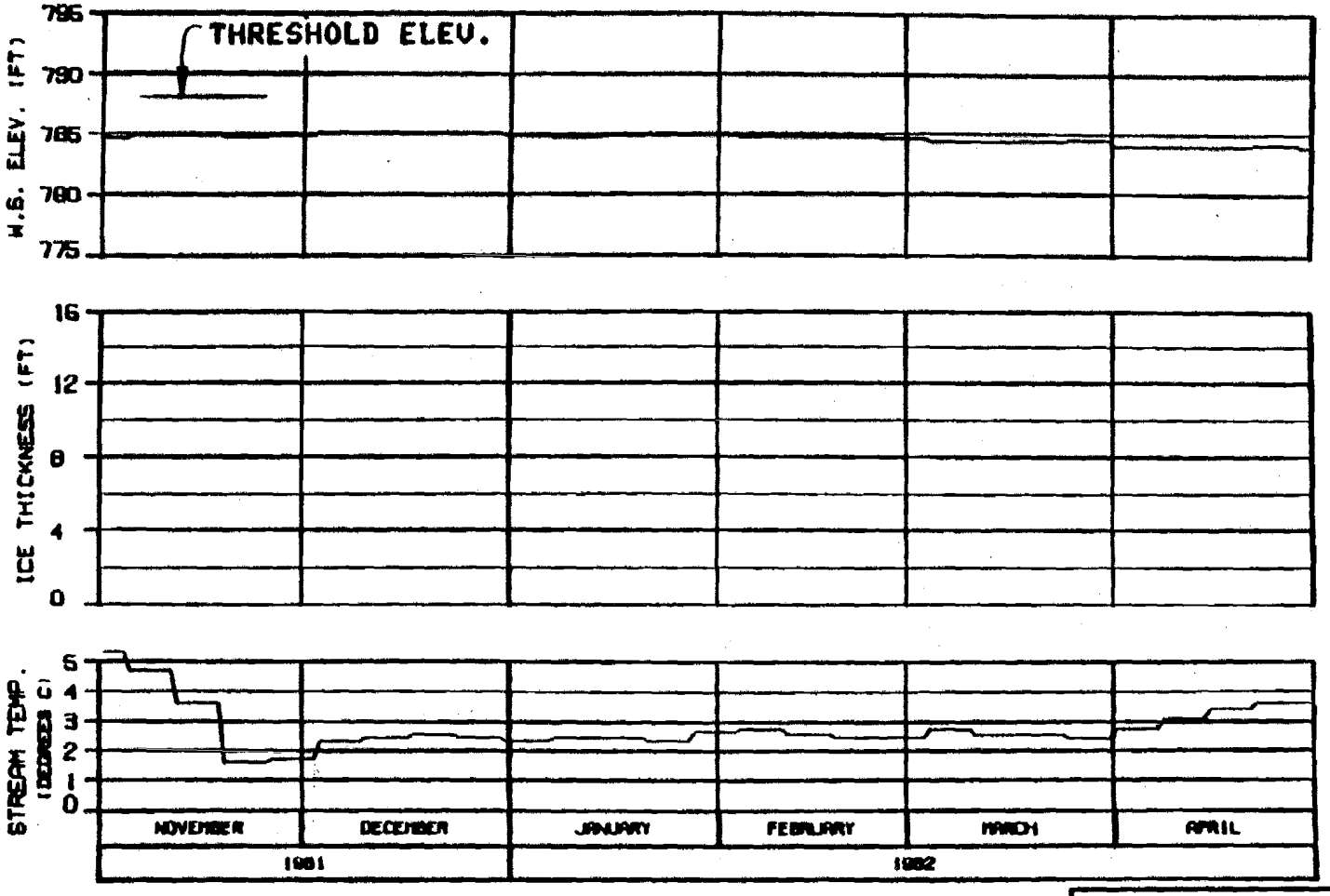
ALASKA POWER AUTHORITY

SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE

C



HEAD OF SLOUGH 22

RIVER MILE : 144.80

ICE THICKNESS LEGEND:

1. TOTAL THICKNESS
2. SLUSH COMPONENT

WEATHER PERIOD : 1 NOV 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
FLOW CASE : C TEMP RULE : NATURAL
REFERENCE RUN NO. : 8102CNA

OPTION2

ALASKA POWER AUTHORITY

SUSITNA PROJECT

SUSITNA RIVER
ICE SIMULATION
TIME HISTORY

HARZA-EBASCO JOINT VENTURE

Exhibit H-8

A COMPARISON OF RIVER ICE SIMULATIONS

FOR

CASE C AND CASE E-VI FLOW REQUIREMENTS

PROJECTED ENERGY DEMANDS FOR - YEAR 2002

- Table of maximum water levels at significant habitat locations
- Comparison of discharges for Case C and Case E-VI
- Comparison of reservoir outflow temperatures for Case C and Case E-VI

Note: Simulations are based on hydrologic and meterologic data from the period November 1981 to May 1982.

SUSITNA HYDROELECTRIC PROJECT
MAXIMUM SIMULATED RIVER STAGES
WINTER 1981-82
WATANA AND DEVIL CANYON - 2002 ENERGY DEMAND

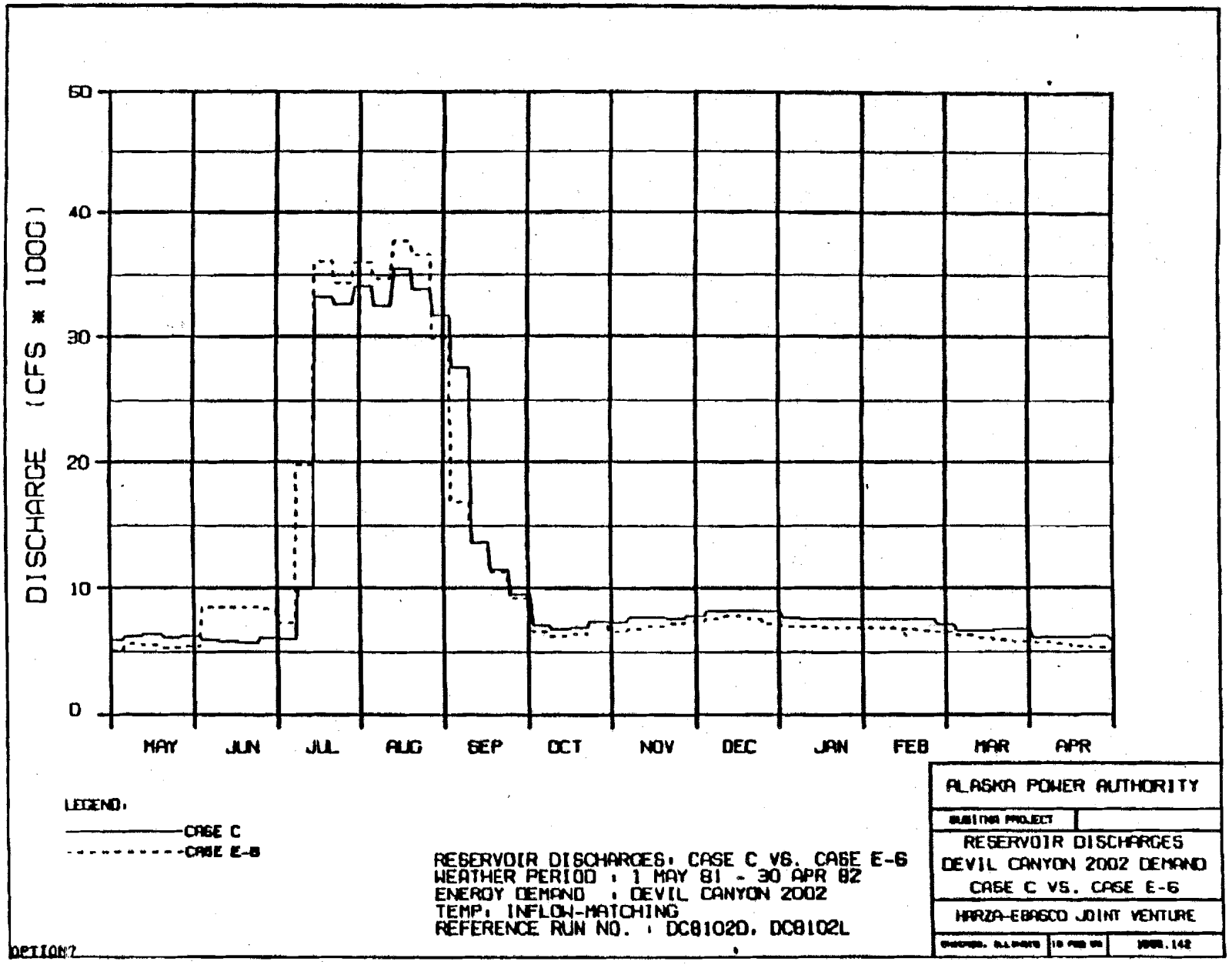
Slough or Side Channel	River Mile	Threshold Elevation	Flow Case C Inflow Matching	Flow Case E-6 Inflow Matching
Whiskers	101.5	367	369	369
Gash Creek	112.0	Unknown	456	456
6A	112.3	(Upland)	458	459
8	114.1	476	475	476
MSII	115.5	482	485	485
MSII	115.9	487	488	488
Curry	120.0	Unknown	520	520
Moose	123.5	Unknown	548	548
8A West	126.1	573	568	571
8A East	127.1	582	580	581
9	129.3	604	601	601
9 u/s	130.6	Unknown	616	616
4th July	131.8	Unknown	627	627
9A	133.7	651	650	649
10 u/s	134.3	657	655	655
11 d/s	135.3	Unknown	667	667
11	136.5	687	682	682
17	139.3	Unknown	714	714
20	140.5	730	728	728
21 (A6)	141.8	747	745	746
21	142.2	755	752	752
22	144.8	788	785	785

LRX-3 Ice Front Starting Date	12-30	12-30
Ice Front Reaches Gold Creek	—	—
Max. Ice Front Extent (River Mile)	124	126
Melt-out Date	3-12	3-19

NOTES:

1. ☐ Indicates locations where maximum river stage equals or exceeds a known slough threshold elevation.
2. All river stages in feet.

C



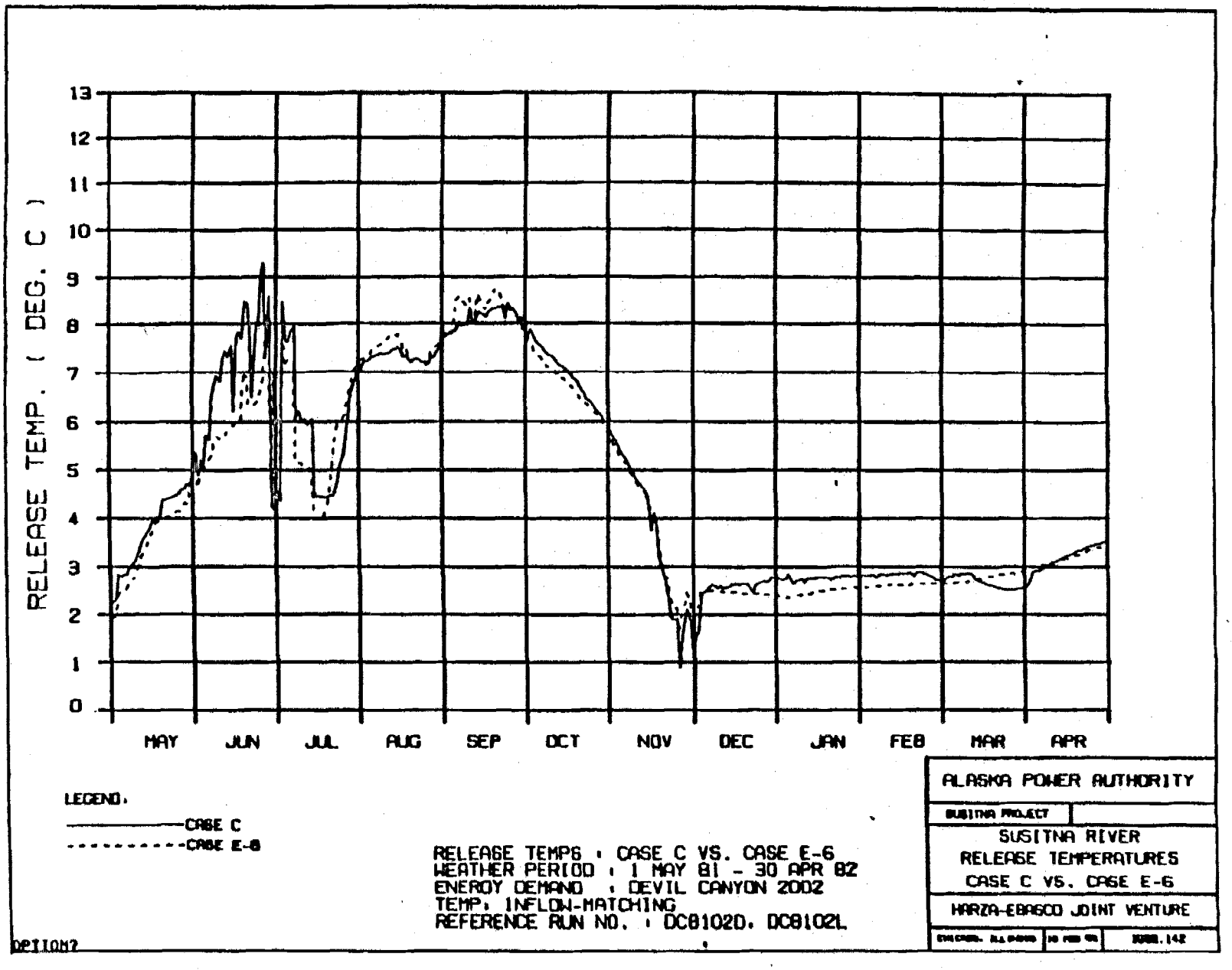
RESERVOIR DISCHARGES: CASE C VS. CASE E-6
WEATHER PERIOD : 1 MAY 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
TEMP: INFLOW-MATCHING
REFERENCE RUN NO. : DC8102D, DC8102L

ALASKA POWER AUTHORITY

RESERVOIR DISCHARGES
DEVIL CANYON 2002 DEMAND
CASE C VS. CASE E-6

HARZA-EBASCO JOINT VENTURE

OPTION?


RELEASE TEMP. (DEG. C)
13
12
11
10
9
8
7
6
5
4
3
2
1
0
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
LEGEND:
CASE C
CASE E-6
RELEASE TEMPS : CASE C VS. CASE E-6
WEATHER PERIOD : 1 MAY 81 - 30 APR 82
ENERGY DEMAND : DEVIL CANYON 2002
TEMP: INFLOW-MATCHING
REFERENCE RUN NO. : DC8102D, DC8102L
OPTION7
ALASKA POWER AUTHORITY
SUSITNA PROJECT
SUSITNA RIVER
RELEASE TEMPERATURES
CASE C VS. CASE E-6
HARZA-EBASCO JOINT VENTURE