

KUMAK CHANNEL CROSSING - LOCATION PLAN
SCALE: NTS

NOTES:

ENGINEERING:

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. RIVER CROSSING PROFILES ARE BASED ON PROFILES PRESENTED IN TWO DOCUMENTS:
 - i) S. TRAYNOR AND S.R. DALLIMORE, 1992. GEOLOGICAL INVESTIGATIONS OF PROPOSED PIPELINE CHANNEL CROSSINGS IN THE VICINITY OF TAGLU AND NIGLINTGAK ISLANDS, MACKENZIE DELTA, NWT., ENVIRONMENTAL RESEARCH STUDIES FUNDS REPORT NO. 116, PUBLISHED BY GEOLOGICAL SURVEY OF CANADA.
 - ii) R.M. HARDY AND ASSOCIATES, JUNE 1977. NIGLINTGAK GAS DEVELOPMENT, MACKENZIE RIVER DELTA NWT., GEOTECHNICAL FIELD PROGRAM, PREPARED FOR SHELL CANADA RESOURCES LTD.
3. THE CONCEPTUAL MINIMUM ALLOWABLE PIPE BEND RADIUS FOR THE NPS 14 FLOWLINE PIPE AND THE NPS 30 CASING PIPE IS 400 m. DETAILED DESIGN STRESS CALCULATIONS MAY ALLOW FOR A SMALLER RADIUS THAT STILL MEETS ALL STRESS CRITERIA.
4. PIPELINE SHALL BE INSTALLED SUCH THAT THE FINAL PIPE PROFILE IS OUTSIDE THE EXCLUSION ZONE. (SEE NOTE 6)
5. FOR CONCEPTUAL DESIGN PURPOSES, ENTRY AND EXIT ANGLES SHALL NOT EXCEED 12 DEGREES TO GRADE. DETAILED STRESS CALCULATIONS MAY ALLOW FOR STEEPER ANGLES THAT STILL MEET ALL STRESS CRITERIA.
6. ESTIMATED LENGTH OF CONCEPTUAL DIRECTIONAL DRILL BORE IS 1040 m. DRILL PROFILE AND EXCLUSION ZONE ARE SUBJECT TO CHANGE AS ADDITIONAL SOILS DATA BECOMES AVAILABLE.
7. DETAILED MEASURES, IF REQUIRED, TO MITIGATE THAW SETTLEMENT SHALL BE DETERMINED DURING THE DETAILED DESIGN PHASE. LAYOUT AND EXTENT OF THERMOSYPHONS REQUIRED TO BE INSTALLED WILL BE BASED ON DETAILED THERMAL ANALYSIS PLUS RESULTS OF ADDITIONAL SITE INVESTIGATIONS.
8. THE PIPE BUNDLE SHALL BE ADEQUATELY SUPPORTED AT ALL TIMES DURING THE PULL-BACK SO AS TO PREVENT OVERSTRESSING THE CASING PIPE AND THE INTERNAL PIPES.

DRILLING FLUID:

9. COMPOSITION OF THE DRILLING FLUID USED SHALL MEET THE PROJECT SPECIFICATIONS OR AS APPROVED BY THE OWNER'S AUTHORIZED REPRESENTATIVE PRIOR TO COMMENCEMENT OF THE DRILLING OPERATION. DURING DRILLING OR PIPE-PULL OPERATIONS, NO SUBSTANCE SHALL BE ADDED TO THE DRILLING FLUID WITHOUT PRIOR WRITTEN AUTHORIZATION FROM THE OWNER'S AUTHORIZED REPRESENTATIVE.
10. DRILLING FLUID, INCLUDING THAT EXITING FROM THE HOLE, SHALL BE CONTAINED IN SUCH A MANNER TO PREVENT FLUID MIGRATION INTO THE WATERCOURSE. THE HDD CONTRACTOR SHALL HAVE A WRITTEN EMERGENCY CLEAN-UP PLAN IN PLACE THAT SHALL BE PRE-APPROVED BY THE OWNER. THE EMERGENCY CLEAN-UP PLAN SHALL ADDRESS BOTH A DRILLING FLUID SPILL AND INADVERTENT DRILLING FLUID RETURNS TO THE SURFACE.

11. DRILLING FLUID SHALL BE DISPOSED OF IN A MANNER THAT MEETS ALL GOVERNMENT REGULATIONS AND THE OWNER'S ENVIRONMENTAL AND ENGINEERING SPECIFICATIONS.

GRADING, EXCAVATING & BACKFILLING & SPOIL DISPOSAL:

12. HDD ENTRY AND EXIT POINTS AND ANY FILL AREAS OR ICE PADS FOR ENCLOSURES SHALL BE BUILT-UP OR GRADED IN A MANNER THAT MEETS THE PROJECT SPECIFICATIONS.
13. PIPELINE SHALL BE PLACED IN NATURAL UNDISTURBED SOIL OR BEDROCK.
14. ANY DISTURBANCE TO THE WATERCOURSE BANKS SHALL BE REPAIRED. BANKS SHALL BE GRADED TO CONFORM AS NEAR AS POSSIBLE TO ORIGINAL PROFILES, OR TO A STABLE SLOPE. SMOOTH AND GRADUAL TRANSITIONS TO THE UNDISTURBED BANKS SHALL BE PROVIDED.

DRAINAGE & EROSION CONTROL:

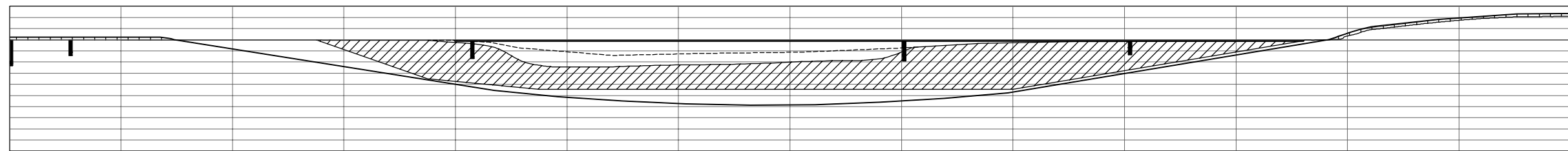
15. SURFACE RUNOFF WATER SHALL BE PREVENTED FROM FLOWING DIRECTLY INTO THE WATERCOURSE FROM OFF THE RIGHT-OF-WAY BOTH DURING AND FOLLOWING CONSTRUCTION. EROSION CONTROL MEASURES SHALL BE INSTALLED AS PER THE SPECIFICATIONS, OR AS DIRECTED BY THE OWNER'S AUTHORIZED REPRESENTATIVE.

ENVIRONMENT:

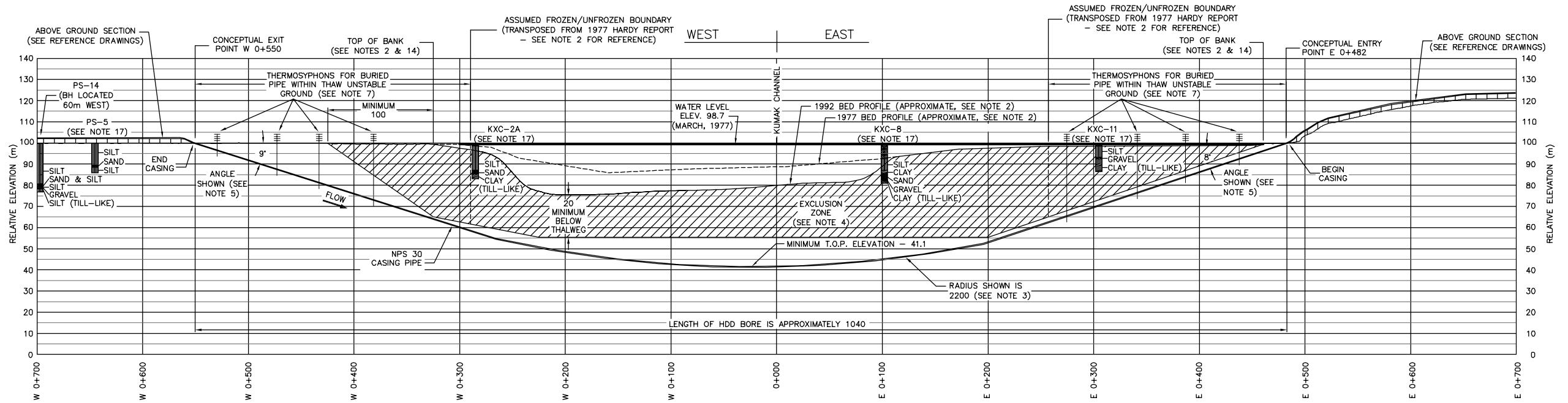
16. A MINIMUM BUFFER ZONE, AMOUNT TO BE AS PER THE SPECIFICATIONS, OF UNDISTURBED VEGETATION SHALL BE LEFT ADJACENT TO THE WATER'S EDGE DURING ANY CLEARING ACTIVITIES.

BOREHOLES:

17. BOREHOLE SOIL DATA TAKEN FROM HARDY 1977 REPORT (SEE NOTE 2)



KUMAK CHANNEL CROSSING
SCALE: 1:2000
PROFILE RATIO - 1:1



KUMAK CHANNEL PROFILE (SEE NOTE 2)

SCALE: HORIZONTAL - 1:2000
VERTICAL - 1:1000

Not to scale
SK-L-0005

Figure 7-7: Conceptual HDD River Crossing Design