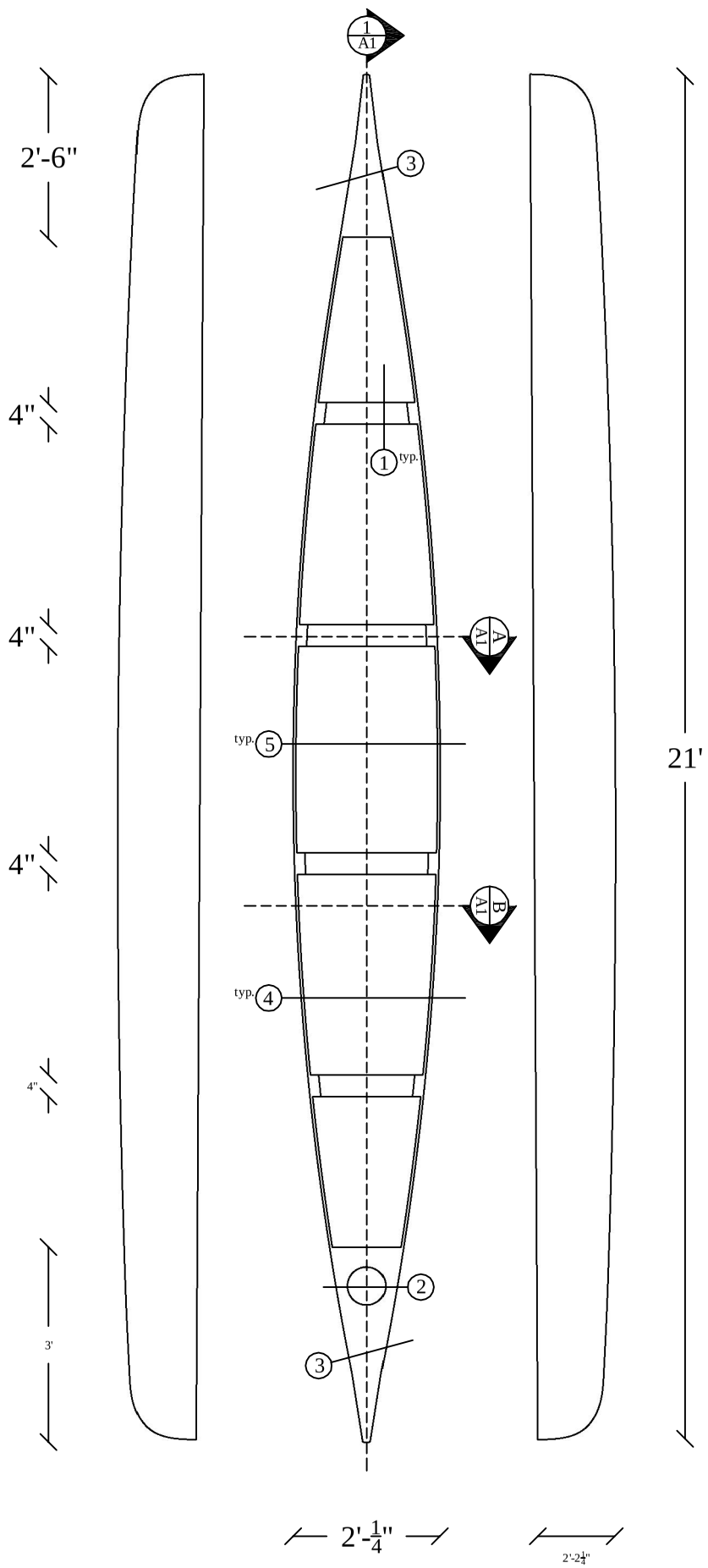
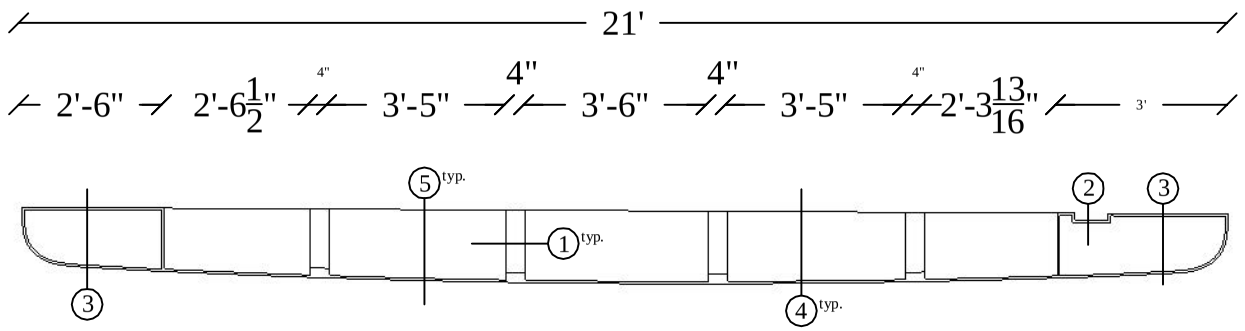


Plan View

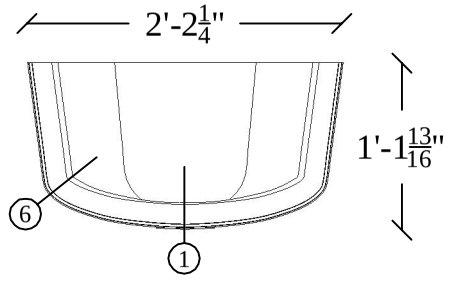
Scale: 1:30



Elevation 1

Scale 1:40

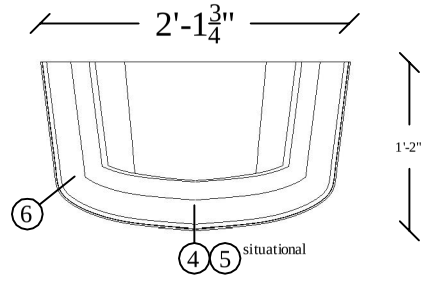
Notes:
Reference Det. 1 for reinforcement grid placement.
Reference Det. 2 for 3D Element visual.
Reference Det. 3 for typical bulkhead layouts and dimensions.
Reference Det. 4 for typical mid-hull cross-section.
Reference Det. 5 for typical mid-hull cross-section w/ overlap.



Notes:
Reference Det. 1 for reinforcement grid placement.
Reference Det. 6 for post-tensioning tendons placement.

Elevation A

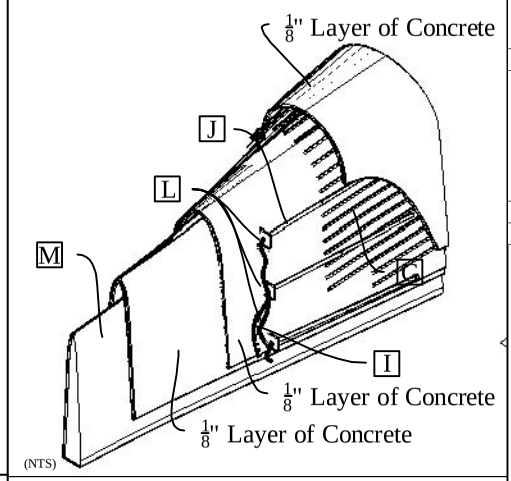
Scale: 1:16

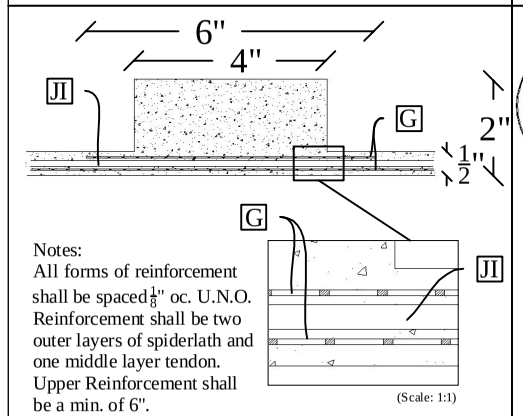


Notes:
Reference Det. 4 and 5 for reinforcement grid placement.
Reference Det. 6 for post-tensioning tendons placement.

Elevation B

Scale: 1:16

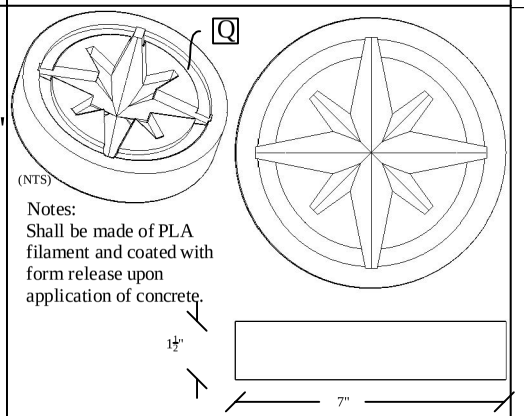




Notes:
All forms of reinforcement shall be spaced 1/8" oc. U.N.O.
Reinforcement shall be two outer layers of spiderlath and one middle layer tendon.
Upper Reinforcement shall be a min. of 6".

1 Typical WT-Shape Reinforced Rib

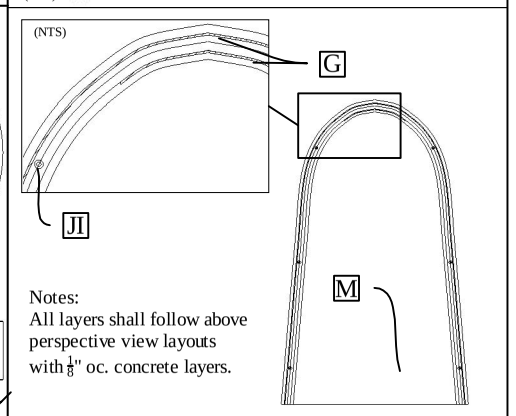
Scale: 1:4 (U.N.O.)



Notes:
Shall be made of PLA filament and coated with form release upon application of concrete.

2 3D Element

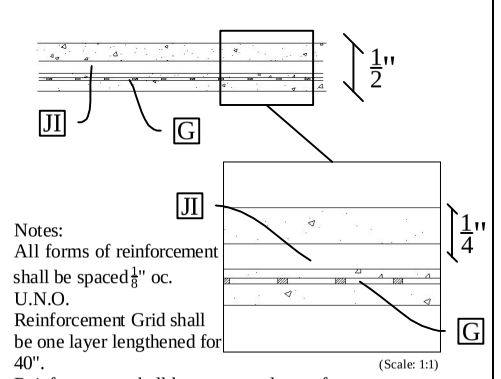
Scale: 1:5 (U.N.O.)



Notes:
All layers shall follow above perspective view layouts with 1/8" oc. concrete layers.

3 Typical Reinforced Bow/Stem Bulkhead

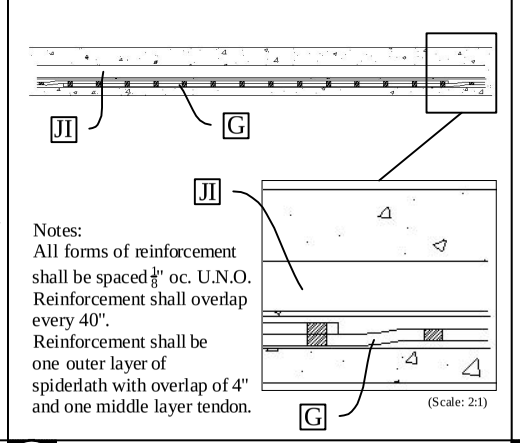
Scale: 1:8 (U.N.O.)



Notes:
All forms of reinforcement shall be spaced 1/8" oc. U.N.O.
Reinforcement Grid shall be one layer lengthened for 40".
Reinforcement shall be one outer layer of spiderlath with one middle layer tendon.

4 Typical Mid-Hull Cross-Section

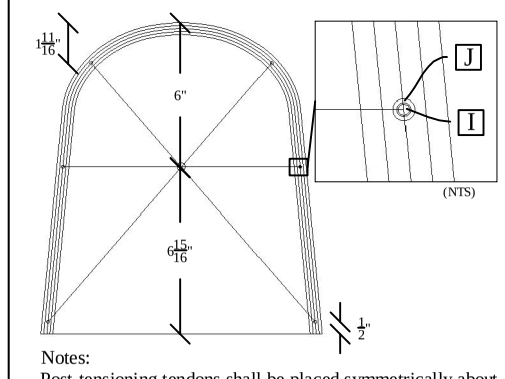
Scale: 1:2 (U.N.O.)



Notes:
All forms of reinforcement shall be spaced 1/8" oc. U.N.O.
Reinforcement shall overlap every 40".
Reinforcement shall be one outer layer of spiderlath with overlap of 4" and one middle layer tendon.

5 Typical Mid-Hull W/ Overlap Cross-Section

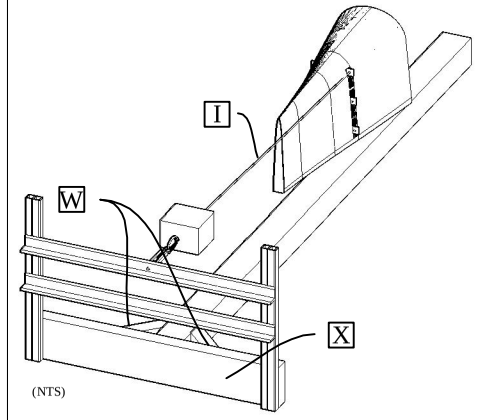
Scale: 1:2 (U.N.O.)



Notes:
Post-tensioning tendons shall be placed symmetrically about the centroid of the cross-section.
Centroid varies across entire length of canoe.

6 Typical Post-Tensioning Placement and Procedure

Scale: 1:6 (U.N.O.)



Bill of Materials:

Item No.	Item Description	Quantity	Unit
	Concrete Constituents		
A	ekkomaxx fly ash	184	LB
B	Poraver Expanded Glass (0.5-1mm)	50	LB
C	3M Glass Bubbles K20	4	LB
D	3M Glass Bubbles S32	15	LB
E	MB AE 90: Air Entraining Admixture	2	LB
F	BASF Black Pigment	9	LB
	Reinforcement/ Post Tensioning		
G	SpiderLath Fiberglass Mesh	105	FT^2
H	3/4" BASF MasterFiber M 100 Fibers	0.3	LB
I	1/16" Galvanized Steel Cable	180	LF
J	1/8" Parflex Nylon Tubing	120	LF
K	13/64" Zinc-plated Copper Button Stops	30	EA
L	1/8" x 1" x 1" Steel Bearing Plates	12	EA
	Floatation		
M	2" x 4" x 8" R-Tech Foam Sheet	3	EA
	Mold		
N	2" x 4" R-Tech Foam Sheets	30	EA
O	Form Oil Releasing Agent	1/2	GAL
P	Uline Plastic Shrink Wrap	100	FT^2
Q	3D Element: Plastic 3D-printed Mold	EA	1
R	3D Element: Foam Lettering	EA	2
	Strongback		
S	Wooden Alignment	1	EA
T	Rotating Steel Plate	4	EA
U	1/2" Bolt	2	EA
V	3/8" Bolt	2	EA
W	Wood 2x4	120	LF
X	Wood 2x6	64	LF
	Finishing		
Y	Pro-Release Sealer	2	GAL

General Notes:

Canoe Parameters:
- Max length shall be 252"
- Max hull thickness shall be 5"
- Max width shall be 27"

Reinforcement:
- Reinforcement shall be a combination of Spiderlath Fiberglass Mesh and (6) 1/16" galvanized steel cables
- Reinforcement shall be spaced 1/8" oc. from each other
- Reinforcement mesh shall have a percent opening of ##% or less
- Total reinforcement thickness shall not exceed half the hull thickness

Concrete:
- Concrete shall have a slump of 5"to 6"
- Concrete shall have a 28-day compressional strength of 1950 psi
- Layers of concrete shall be sprayed at 1/8" layers
- Clear cover shall be at minimum 1/8" to maintain sufficient bonding

Post-Tensioning System:
- Shall be able to hold tensioning each tendon to 85 *lbs* without buckling.
- Order to tension each tendon is as follows:
  - -- top-left tendon
  - -- bottom-right tendon
  - -- top-right tendon
  - -- bottom-left tendon
  - -- middle-right tendon
  - -- middle-left tendon

Revised By:

Rev. No.	Date	Rev. Details

Polaris

Address:
Engineering Bldg. 2112 S Huffer Ln.
Flagstaff, AZ 86011

ASCE NAU

Northern Arizona University

Concrete Canoe:
Construction Draft Plan "A"

Drawn By: BJL
Date Drawn: 2/26/16
Reviewed By:
Date Reviewed:

Polaris

Sheet: A1

Of: A1