APPENDIX F
PROJECT ENGINEERING DETAILS

APPENDIX F-1

PUMP SELECTION SUBMITTAL

APPENDIX F-2

RIVANNA RIVER HDD SELECT SHEETS

APPENDIX F-1
PUMP SELECTION SUBMITTAL

GOULDS WATER TECHNOLOGY a xylem brand

SUBMITTAL

Quote ID: 9007-181105-004:0:1 QTY: 1
VIT-FFFM 14RJHC, 6 Stages
TMC Municipal

PERFORMANCE ON DESIGN CURVE AT 1770 RPM

	Shut Off	Design [2]	Run Out [5]		
Flow (USGPM)	0.0	2100.0	0.0	**Best Efficiency**	87.70 % at 2262.0 USgpm
TDH-Bowl (ft)	596.0	464.0	0.0	**Design Flow % BEP**	92.84 %
TDH-Disch Flange (ft)	555.0	419.5		**Pump Efficiency**	85.99 %
Bowl Efficiency (%)	-	87.20	-	**Overall Efficiency**	0.00 %
Power (Hp)	-	282.0		**Max Power (NOL)**	301.0 Hp at 3000.0 USgpm
NPSHr (ft) [1]	-	31.0	-	**Max Power (NOL) at Max Trim**	347.0 Hp at 3000.0 USgpm
NPSH Margin (ft) [1]	-	20.4		**Specified NPSH Ratio**	1.1
Hydraulic Thrust(lb)	9655.2	7516.8	0.0	**Thrust Load Power Loss**	1.09949 Hp
Thrust (lb)	10313.9	8168.6			1.00
Pressure-Bowl (psi)	258.0	200.9	-	**Total Head Derate Factor**	1.00
Pressure-Disch Flange (psi)	240.3	181.6	-	**Total Efficiency Derate Factor**	1.00
Min Submergence (Inch) [3]	-	43.48	-	**Actual Submergence**	230.52 in
Friction Loss (ft) [4]	-	3.47	-	**Shaft Friction Power Loss**	0.74 Hp
Lineshaft Elongation (Inch)	0.09379	0.07302	-	**Min Flow (MCSF)**	566.0 USgpm
Column Elongation (Inch)	0.01575	0.01155	-	**kWh per 1000 gal**	0.00000
Lateral (Inch)	0.20804	0.19146	-	**Impeller Running Clearance**	0.13 in

[1] at 1st impeller eye [2] rated values [3] from bottom of pump [4] from bowl to disch flange [5] based on user entered TDH

OPERATING CONDITIONS

Specified Flow	2100.00 USgpm
Specified TDH	460.00 ft
Rated Speed	1770 RPM
Atmospheric Pressure	15 psi
TPL	59.21 ft
Pumping Level	40.00 ft
NPSHa at 1st Impeller	51.4 ft
NPSHa at Grade	33.9 ft

FLUID CHARACTERISTICS

Fluid	Water
Fluid Temperature	68.0 °F
Specific Gravity	1.0000
Viscosity	1.0017 cP
Vapor Pressure	0.3393 psi
Density	62 lbs/ft³

MATERIALS & DIMENSIONS

Bowl Data	
Bowl Material	Cast Iron with Glass Enamel
Bowl Material Derate Factor	1.00
Impeller Material	316SS
Additional Stage Impeller Material	316SS
Impeller Matl Derate Factor	1.00
Bowl Shaft Material	416SS
Impeller Attachment	Keyed
Key Material	416SS
Discharge Bowl Material	Not Included
Suction Type	Bell
Suction Material	Cast Iron
Bowl Bolting Material	Carbon Steel
Sand Collar	Not Included
Pipe Plug	Iron
Suction Bearing	Vesconite
Discharge Bowl Bearing	Not Included
Intermediate Bowl Bearing	Vesconite
Strainer Type	Not Included
Tube Adapter Bearing Material	Not Included
Impeller Trim	9.13 in

Bowl Data	
Max Impeller Trim	9.82 in
Thrust K-Factor	16.2 Lb/Ft
Bowl Pressure Limit	700 psi
Available Lateral	1.25 in
Bowl Assembly Length (BL)	80.50 in
Disch Bowl Length OLS (O1)	5.25 in
Disch Bowl Length ELS (L2)	9.00 in
Bowl Shaft Diameter	1 15/16"
Impeller Balance	Dynamic Two Plane Balance
Impeller Design	Enclosed
Bowl Wear Ring	416SS
Impeller Wear Ring	416SS
Suction Pipe Diameter	No Suction Pipe
Bowl Diameter (D)	13.63 in
Bowl Length (L3)	11.50 in
Bowl Flange Diameter (A)	5.06 in
Bowl Flange Thickness (E)	9.63 in
Floor Clearance (X)	9.50 in
Min Column Diameter	8 in
Max Column Diameter	14 in
Max Bowl Shaft Diameter	1.94 in
Bowl Shaft Length	89.25 in

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Certified By		
Project	James River Raw Water Pumps Revised 100518	
Tag	3 MGD	
PO Number		
Serial Number		

Bowl Data

Bowl Shaft Power Limit	448.83 Hp

Bowl Specials

Column Data

Column Type	Flanged
Column Diameter	10"
Lineshaft Diameter	1 11/16 in [42.9 mm]
Column Bolting	Carbon Steel
Column Pipe Material	Carbon Steel
Lineshaft Material	416SS
Lineshaft Bearing Material	Vesconite
Lineshaft Coupling Type	Threaded
Lineshaft Coupling Material	416SS
Column Loss	2.01 ft
Column Flange	Carbon steel
Column Shaft Sleeve	Not Included
Column Bearing Retainer	304SS
Column Bearing Options	Not Included

Column Data

Column Retainer Design	Separate
Maximum Bearing Spacing	5 ft Spacing
Max Column Section Length	120 in
Number of Bearings	10
Fabrication Welding Option	Not Included
Column Length (COL)	630.02 in
Column Wall Thickness	0.36 in
Column Load	6356.8 lb
Lubrication Method	Water (Open Lineshaft)
Lineshaft Length	630.02 in
Head Sleeve	Not Included
Lineshaft Power Limit	381 Hp

Column Specials

Head Data

Head Type	Type FF (Fabricated F-Head)
Discharge Flange Rating	150 #
Disch Flange Pressure Limit	285 psi
Head Design	One Piece Head
Discharge Head Material	Carbon steel
Headshaft Material	416SS
Headshaft Coupling Type	Type AS Adjustable Spacer
Coupling Assembly	Carbon Steel
Headshaft Diameter (BX)	1.69 in
Discharge Head Size	10"
Discharge Head BD	20"
Sealing Method	Mechanical Seal
Tension Plate	Not Included
Mechanical Seal	Chesterton 155 1DCW
Seal Provided By	Xylem
Seal Mounted By	Customer

Head Data

Stuffing Box / Seal Hsg Bolt	316SS
Stuffing Box / Seal Hsg Brg	Vesconite
Seal Housing Material	Cast iron
Steel Sub Base	Carbon Steel
Head Loss	1.46 ft
150# Disch Companion Flg	Not Included
300 # Suct Convenience Flg	No suction flange
Column Hanger Flange	Not Included
Head Sleeve	Not Included
Head Bolting	316SS
Split Gland	316SS
Motor Stand	Not included
Air Vacuum Valves	Not Included
Fabrication Welding Option	Not Included

Head Specials

155 Seal Faces are SC/SC

Motor Data

Driver Type	Vertical Solid Shaft Motor
Motor Manufacturer	US Motors
Selected Motor Power	350
Voltage	460
Phase / Frequency	3/60
Enclosure	WP1
Motor Frame	447TPA
Inverter Duty	Yes
Steady Bushing	No
Motor Coupling	Adjustable
Insulation Class	F
Service Factor	1.15 Sine
Motor Provided By	Xylem
Motor Mounted By	Customer

Motor Data

HP Rating	350 Hp
Voltage	460 V
Speed [Poles]	1800 rpm [4 pole]
Thrust Level	100% HT
BD	20.0 in
BX / U	1.69 in
Enclosure	WPI
Efficiency / Config	Premium Inverter Duty
Coupling	NRR w/o Steady Bushing
Manufacturer	US
Winding Thermal	Thermostats
Conduit Box	Standard w/ Accessory Box

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GOULDS WATER TECHNOLOGY a xylem brand

SUBMITTAL

Quote ID: 9007-181105-004:0:1 QTY: 1
VIT-FFFM 14RJHC, 6 Stages
TMC Municipal

Motor Data

Options 1	Space Heater & Shaft Grounding Ring & Insulated Bearing (Upper)
Mfg Catalog Number	

Motor Data

Motor Part Number	
Driver Size Criteria	Max power on design curve (NOL)

Motor Specials

Coating Data

Bowl OD	Goulds Water Technology Standard Blue Enamel
Column ID	Not Included
Column OD	Goulds Water Technology Standard Blue Enamel
Column Bearing Retainer	Not Included
Can ID	Not Included

Coating Data

Head ID	Not Included
Head OD	Goulds Water Technology Standard Blue Enamel
Enclosing Tube OD	Not Included
Steel Sub Base	Not Included

Testing Data

Performance Testing	Bowl Assembly Only Non-Witness Lab Motor
Hydrostatic Testing	Discharge Head Non-Witness

Miscellaneous Specials

Weight Data

Total Bowl Weight	1165 lbs
Unit Bowl Weight	390 lbs / 155 lbs
Total Column Weight	3180 lbs
Unit Column Weight	60 lbs
Head Weight	735 lbs

Weight Data

Motor Weight	2100 lbs
Total Weight	7180 lbs
Total Rotating Weight	628 lbs

INFO, WARNING & ERROR MESSAGES

	Invalid	is invalid

Our offer does not include specific review and incorporation of any Statutory or Regulatory Requirements and the offer is limited to the requirements of the design specifications. Should any Statutory or Regulatory requirements need to be reviewed and incorporated then the Customer is responsible to identify those and provide copies for review and revision of our offer.

Our quotation is offered in accordance with our comments and exceptions identified in our proposal and governed by our standard terms and conditions of sale – Xylem Americas attached hereafter.

For units requiring performance test, all performance tests will be conducted per ANSI/HI 14.6 standards unless otherwise noted in the selection software submittal documents. Test results meeting with grade 2B tolerances for pumps with a rated shaft power of 134HP or less and grade 1B for greater than 134HP will be considered passing.

Customer is responsible for verifying that the recommendations made and the materials selected are satisfactory for the Customer's intended environment and Customer's use of the selected pump. Customer is responsible for determining the suitability of Xylem recommendations for all operating conditions within Customer's and/or End User's control. Xylem disclaims all warranties, express or implied warranties, including, but not limited to, warranties of merchantability and fitness for a particular purpose and all express warranties other than the limited express warranty set forth in the attached standard terms and conditions of sale – Xylem Americas attached hereafter.

Xylem does not guarantee any pump intake configuration. The hydraulic and structural adequacies of these structures are the sole responsibility of the Customer or his representatives. Further, Xylem accepts no liability arising out of unsatisfactory pump intake field operating conditions. The Customer or his representatives are referred to the Hydraulic Institute Standards for recommendations on pump intake design. To optimize the hydraulic design of a field pump intake configuration, the Customer should strongly consider performing a detailed scale model pump intake study. However, the adequacies of these recommendations are the sole responsibility of the Customer.

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OUTLINE DRAWING

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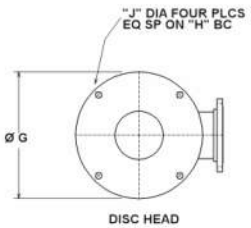
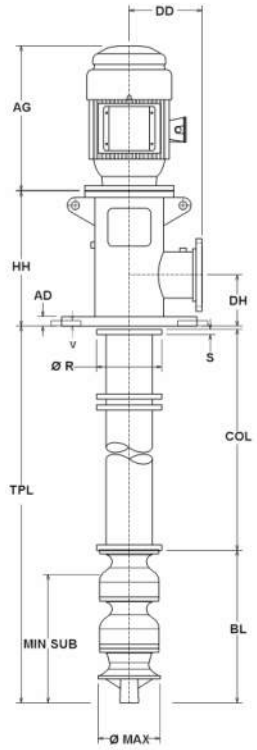
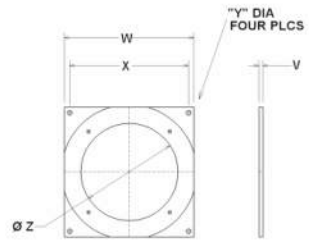
VIT-FFFM 14RJHC, 6 Stages
TMC Municipal



DISC HEAD





SOUL PLATE

DIMENSIONS

G [Mounting Flange Dia]	25.00 in
J [Mounting Flange Hole Dia]	1.25 in
K [Mounting Hole Places]	12
H [Mounting Flange Bolt Circle]	22.75 in
BD Head [Discharge Head Base Dia]	20.00 in
HH [Head Height]	44.00 in
AD [Mounting Flange Thickness]	1.75 in
DD [Disch Flange Stickout]	17.50 in
DH [Disch Flange Height]	12.00 in
S [Hanger Flange Stickdown Length]	1.13 in
R [Hanger Flange OD]	14.60 in
Column Length (COL)	630.02 in
COL [Column Diameter]	10.00 in
TPL [Total Pump Length]	710.52 in
MIN SUB [Minimum Submergence]	43.48 in
MAX [Max Assembly OD]	13.63 in
BL [Bowl Assembly Length]	80.50 in
V [Sub Base Thickness]	1.00 in
W [Sub Base Overall Size]	25.00 in
X [Center Line of Holes]	22.00 in
Y [Mounting Holes Base Plate Dia]	1.00 in
Z [Base Plate Opening or Can ID]	19.00 in

PUMP DATA

Column Diameter	10"
Lineshaft Diameter	1 11/16 in
Specified Flow	2100.00 USgpm
Specified TDH	460.00 ft
Pumping Level	40.00 ft
Motor Manufacturer	US Motors
Driver Type	Vertical Solid Shaft Motor
Selected Motor Power	350
Phase / Frequency	3/60
Voltage	460

WEIGHTS

Total Bowl Weight	1165 lbs
Unit Bowl Weight	390 lbs / 155 lbs
Total Column Weight	3180 lbs
Unit Column Weight	60 lbs
Head Weight	735 lbs
Motor Weight	2100 lbs
Total Weight	7180 lbs
Total Rotating Weight	628 lbs

NOTES	
1	Total Pump Length ± 1.0 inch.
2	Tolerance on all dimensions is .12 or ± .12 inch per 5 ft, whichever is greater.
3	All dimensions shown are in inches unless otherwise specified.
4	Drawing not to scale.
5	½" NPT – Gauge Conn (plugged)
6	Driver may be rotated at 90° intervals about vertical centerline for details refer to driver dimension drawing.
7	Refer to product IOM for impeller setting requirements.
8	This assembly has been designed so that its natural frequency responses avoid the specific operating speeds by an adequate safety margin. The design has assumed the foundation to be rigid.

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CROSS SECTION DRAWING

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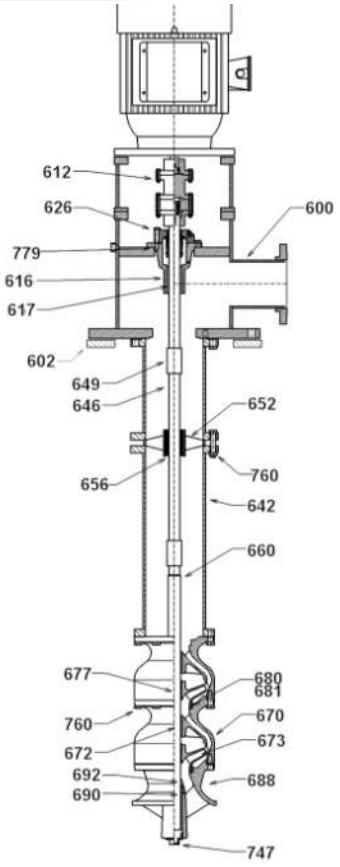
TMC Municipal



BILL OF MATERIALS

ITEM	PART NAME	CODE	MATERIAL	ASTM#
Head Assembly				
608	Headshaft	2227	SST 416	A582 S41600
600	Head-Discharge	9645	Carbon Steel Fab	A53
602	Sub Base	3201	Carbon Steel Gr D	A36M
604	Nut – Adjusting	2242	Carbon Steel 1018	A108
605	Motor Stand	NA	NA	NA
612	Coupling Assembly	5932	Carbon Steel 1215 Zinc	A108
616	Housing	1003	Cast Iron Cl30	A48 CLASS 30B
617	Bearing-Housing	6397	Vesconite H/L	x
618	Gland-Split	1203	SST 316	A744M
625	Tension Plate	N/A	Not Included	N/A
626	Mechanical Seal	0000	Chesterton 155 1DCW	
637	Hanger Flange	N/A	Not Included	N/A
648	Headshaft Sleeve	N/A	N/A	N/A
730	Key-Motor Gib	2242	Carbon Steel 1018	A108
760	Head Bolting	2229	SST 316	A276
779	Gasket-Housing	5136	Acrylic/Nitrile	5136 REV 4
Column Assembly				
637	Column Flange	9645	Carbon Steel Fab	A53
642	Column Pipe	6501	Black Pipe Sch 40	A 53
646	Lineshaft	2227	SST 416	A582 S41600
649	Lineshaft-Coupling	2265	SST 416	A582M
652	Retainer-Bearing	1205	SST 304	A744M
656	Lineshaft Bearing	6397	Vesconite H/L	x
Bowl Assembly				
660	Shaft - Bowl	2227	SST 416	A582 S41600
661	Discharge Bowl	NA	Not Included	Not Included
664	Bearing - Discharge Bowl	N/A	Not Included	N/A
668	Bearing Tube Adapt	N/A	Not Included	N/A
670	Bowl - Intermediate	6911	Cast Iron Cl30 Enamel	A48
672	Bearing - Intermediate Bowl	6397	Vesconite H/L	x
673	Impeller	1203	SST 316	A744M
673	Impeller	1203	SST 316	A744M
674	Key-Impeller	2217	SST 416	A582M
680	Wear Ring-Bowl	1299	SST CA15	A743M
681	Wear Ring - Impeller	2217	SST 416	A582M
688	Suction	1003	Cast Iron Cl30	A48 CLASS 30B
690	Bearing - Suction	6397	Vesconite H/L	x
692	Sandcollar	NA	Not Included	NA
747	Pipe Plug	1046	Malleable Iron	A197
760	Capscrew-Hex	2298	Steel Bolting Gr 8	J429

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PERFORMANCE CURVE

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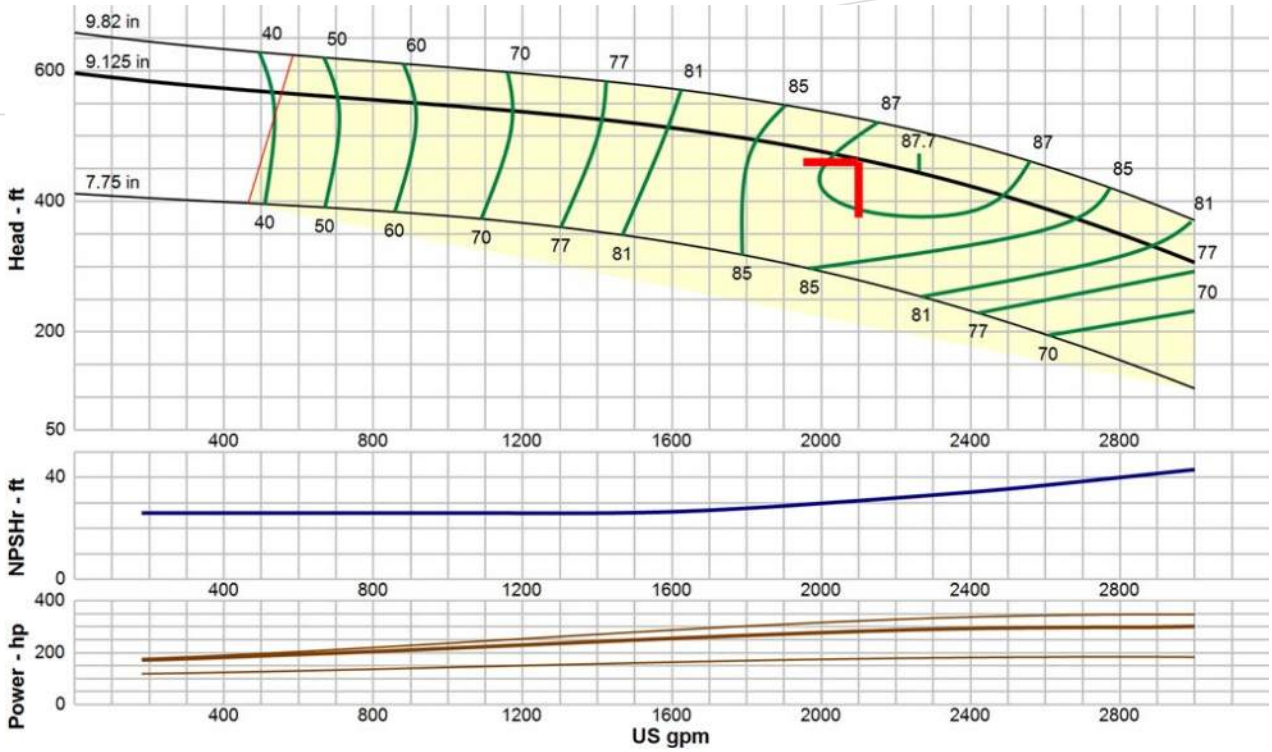
TMC Municipal



CURVE DATA

Specified Flow	2100.00 USgpm	**Shut Off TDH (Bowl)**	596.0 ft	**Specified NPSH Ratio**	1.1
Specified TDH	460.00 ft	**Shut Off TDH (Disch Flange)**	555.0 ft	**NPSH Margin at Design**	20.4 ft
Atmospheric Pressure	15 psi	**Shut Off Pressure (Bowl)**	258.0 psi	**Min Submergence at Design**	43.48 in
TPL	59.21 ft	**Shut Off Pressure (Disch Flange)**	240.3 psi	**Actual Submergence**	230.52 in
Pumping Level	40.00 ft	**Bowl Efficiency at Design**	87.20 %	**Shaft Friction Power Loss**	0.74 Hp
NPSHa at Grade	33.9 ft	**Best Efficiency**	87.70 %	**Thrust Load Power Loss**	1.09949 Hp
NPSHa at 1st Impeller	51.4 ft	**BEP Flow**	2262.0 USgpm	**Hydraulic Thrust at Design**	7516.8 lb
Fluid	Water	**Design Flow % BEP**	92.84 %	**Thrust at Design**	8168.6 lb
Fluid Temperature	68.0 °F	**Pump Efficiency**	85.99 %	**Hydraulic Thrust at Shut Off**	9655.2 lb
Specific Gravity	1.0000	**Friction Loss at Design**	3.47 ft	**Thrust at Shut Off**	10313.9 lb
Viscosity	1.0017 cP	**Power at Design**	282.0 Hp	**Bowl Material**	Cast Iron with Glass Enamel
Vapor Pressure	0.3393 psi	**NOL Power**	301.0 Hp		
Density	62 lbs/ft³	**Max Power (NOL) Flow**	3000.0 USgpm	**Bowl Material Derate Factor**	1.00
Design Flow	2100.0 USgpm	**Max Power (NOL) at Max Trim**	347.0 Hp	**Impeller Material**	316SS
Min Flow (MCSF)	566.0 USgpm	**Max Power (NOL) Flow at Max Trim**	3000.0 USgpm	**Impeller Matl Derate Factor**	1.00
Design TDH (Bowl)	464.0 ft			**Total Flow Derate Factor**	1.00
Design Pressure (Bowl)	200.9 psi	**kWh per 1000 gal**	0.00000	**Total Efficiency Derate Factor**	1.00
Design Pressure (Disch Flange)	181.6 psi	**NPSHr at Design**	31.0 ft	**Curve ID**	E6414RCPC2

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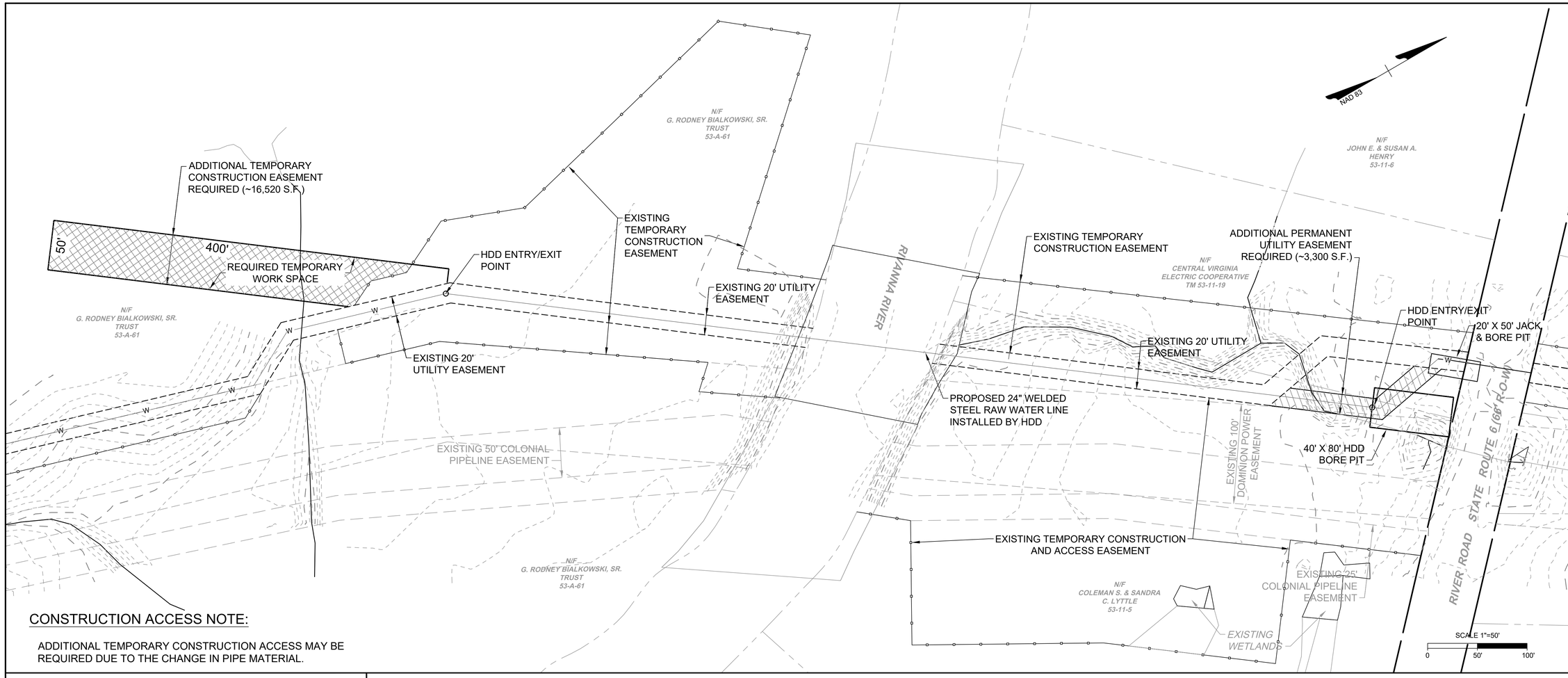
APPENDIX F-2
RIVANNA RIVER HDD SELECT SHEETS



CONSTRUCTION ACCESS NOTE:

ADDITIONAL TEMPORARY CONSTRUCTION ACCESS MAY BE REQUIRED DUE TO THE CHANGE IN PIPE MATERIAL.

NOTES:

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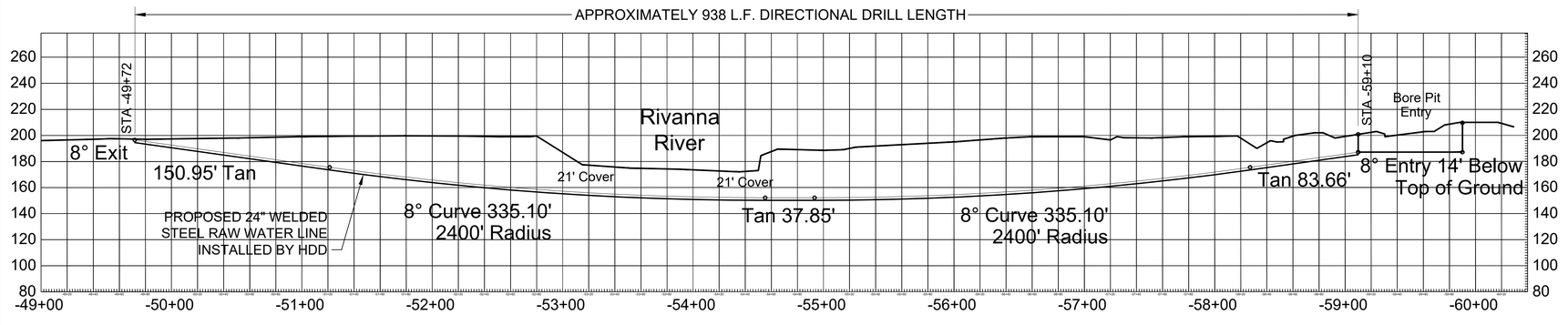

Vertical Geometry						
PVI #	PVI Sta	PVI Elev	Type	Rad / Length	Reverse	Incl
1	-59+10	187.14	Tan Point			0.00
2	-58+27	175.49	Vertical PC	2400.000	No	82.00
3	-54+93	152.14	Vertical PT			90.00
4	-54+55	152.14	Vertical PC	2400.000	No	90.00
5	-51+21	175.49	Vertical PT			98.00
6	-49+72	196.50	Tan Point			98.00

Horizontal Geometry						
From	Station	Azimuth	Dist / Arc	RP #	Radius	To
1	-49+72	217.08	938.21			2

HORIZONTAL DIRECTIONAL DRILLING (HDD)
CONCEPTUAL DRAWING FOR
THE RIVANNA RIVER CROSSING

NOT FOR CONSTRUCTION

THIS DRAWING PREPARED AT THE
CORPORATE OFFICE
1001 Boulders Parkway, Suite 300 | Richmond, VA 23225
TEL 804.200.6500 FAX 804.560.1016 www.timmons.com

YOUR VISION ACHIEVED THROUGH OURS.

REVISION DESCRIPTION

DATE

DATE
MARCH 2020
DRAWN BY
DESIGNED BY
CHECKED BY
SCALE
AS SHOWN

TIMMONS GROUP

JAMES RIVER WATER PROJECT
JAMES RIVER WATER AUTHORITY - FLUVANNA COUNTY, VIRGINIA
HDD CONCEPTUAL LAYOUT DETAILS

JOB NO.
33927
SHEET NO.
DD-1

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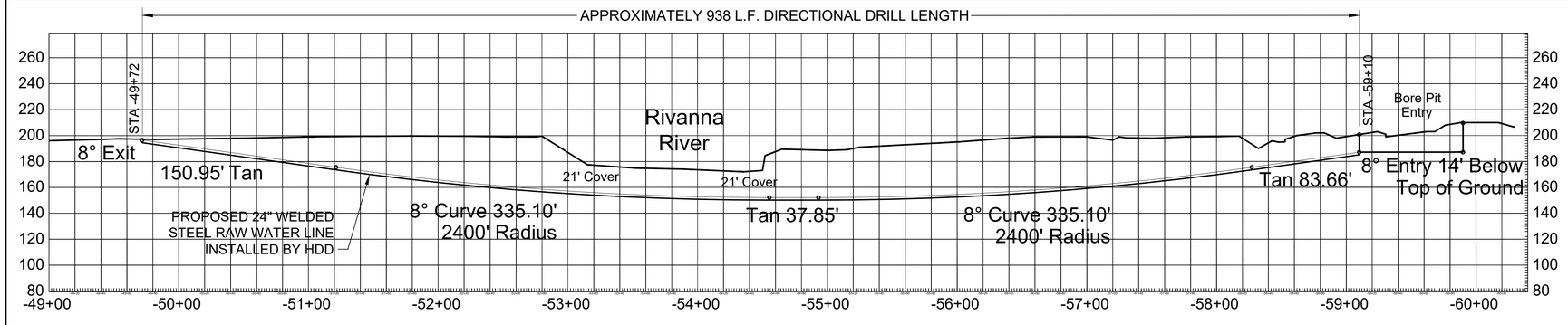

Vertical Geometry						
PVI #	PVI Sta	PVI Elev	Type	Rad / Length	Reverse	Incl
1	-59+10	187.14	Tan Point			0.00
2	-58+27	175.49	Vertical PC	2400.000	No	82.00
3	-54+93	152.14	Vertical PT			90.00
4	-54+55	152.14	Vertical PC	2400.000	No	90.00
5	-51+21	175.49	Vertical PT			98.00
6	-49+72	196.50	Tan Point			98.00

Horizontal Geometry						
From	Station	Azimuth	Dist / Arc	RP #	Radius	To
1	-49+72	217.08	938.21			2

HORIZONTAL DIRECTIONAL DRILLING (HDD)
CONCEPTUAL DRAWING FOR
THE RIVANNA RIVER CROSSING

NOT FOR CONSTRUCTION

THIS DRAWING PREPARED AT THE
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YOUR VISION ACHIEVED THROUGH OURS.

TIMMONS GROUP

JAMES RIVER WATER PROJECT
JAMES RIVER WATER AUTHORITY - FLUVANNA COUNTY, VIRGINIA
HDD CONCEPTUAL LAYOUT DETAILS

REVISION DESCRIPTION	DATE

DATE: MARCH 2020
DRAWN BY:
DESIGNED BY:
CHECKED BY:
SCALE: AS SHOWN

JOB NO. 33927
SHEET NO. DD-1