



**OHIO DEPARTMENT OF TRANSPORTATION**

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# **Borehole Sealing**

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# Borehole Sealing Update

- ④ **SGE Appendix F was developed in 1995. Has not been significantly updated since.**

## **APPENDIX F**

### **POLICY FOR SEALING OF GEOTECHNICAL EXPLORATORY BOREHOLES**



# Borehole Sealing Update

- ④ Updated for clarity.

- ④ Now presented as:

**Section 407 Sealing or Backfilling of Borings**

- ④ Will be included in the **July 2016 SGE Update**



# HIGHLIGHTS

- ④ **Backfilling:** Mixture of soil and Bentonite Chip
- ④ Boring  $\leq 10$  ft. depth.
- ④ Boring encountered predominately granular soils ( $>75\%$  of profile).
- ④ Did not encounter static ground water level considered to be hydraulically connected with the ground water table (naturally occurring static water).
- ④ Maximum depth 40 ft.
- ④ Compact upper 10 ft. & Match surface material



# HIGHLIGHTS

## ☉ Sealing:

### ☉ Options:

☉ Bentonite Chips or Pellets (BCP)

☉ High Solids Bentonite Grout (HSB)

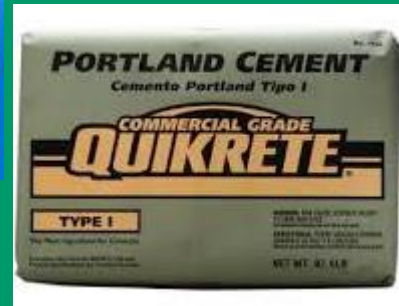
☉ Neat Portland Cement Grout (PC)

☉ Cement Bentonite Grout (C/B)

☉ Grout placement through tremie method



# HIGHLIGHTS



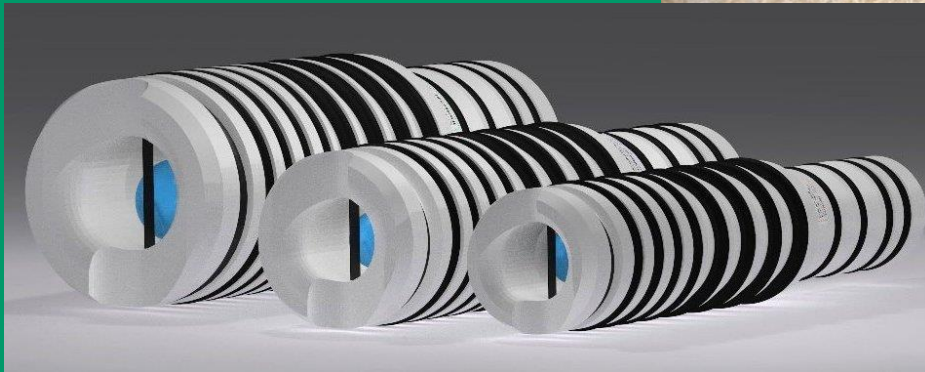
# HIGHLIGHTS

## ☉ Special Conditions:

- ☉ Stream Beds: Boreholes  $\leq 12$  inches advanced through standing water – DO NOT BACKFILL OR SEAL – allow natural material to fill open borehole.
- ☉ Voids: Must use a shale trap or grouting basket/plug.
- ☉ Flowing Artesian: Capture artesian head to determine hydrostatic pressure. Then grout, may need heavier mud or grouting packers.



# HIGHLIGHTS





# New Appendix F

**Table F.1: Appropriate Materials for Sealing of Borehole**

Borehole Diameter	Depth to Boring (Ft)	Appropriate Type of Seal			
		BCP	HSB	PC	C/B
< 3.9 inches (<100 mm)	10 – 40 ft.	✓	✓	✓	✓
	>40 ft.		✓	✓	✓
3.9 – 7.9 inches (100 – 200 mm)	10 – 40 ft.	✓	✓	✓	✓

**Table F.2. Recommended Use of Bentonite Pellets and Chips**

Boring Diameter (in)	Depth of Boring (Ft)	Pellets			Chips	
		¼-in	⅜-in	½-in	Medium	Coarse
< 3.9 inches (<100 mm)	<10	✓	✓		✓	✓
	10 - 40	✓	✓	✓	✓	✓
3.9 – 7.9 inches (100 – 200 mm)	<10	✓	✓		✓	✓
	10 - 40	✓	✓	✓	✓	✓
>7.9 inches (>200 mm)	<10	✓	✓	✓	✓	✓
	10 - 40	✓	✓	✓	✓	✓



# New Appendix F

**Table F.3: Typical Grout Mixture Designs**





w/c	Neat Portland Cement Grout			Cement Bentonite Grout		
	Vol. Water (gal)	Cement (lbs.)	Bentonite (lbs.)	Vol. Water (gal)	Cement (lbs.)	Bentonite (lbs.)
0.62	7 (26 liters)	94 (43 kg)	None	7 (26 liters)	94 (43 kg)	4.7 (2.1 kg)
0.53	6 (23 liters)	94 (43 kg)	None	6 (23 liters)	94 (43 kg)	4.7 (2.1 kg)
0.44	5 (19 liters)	94 (43 kg)	None	5 (19 liters)	94 (43 kg)	4.7 (2.1 kg)



Table F.4: Total Hydrostatic Pressure for Flowing Artesian Conditions (psi)

Depth to Top of water bearing Stratum (ft)	Estimated Head Pressure Above Ground Surface (ft)					
	5	10	15	20	25	30
10	6.5	8.7	10.8	13.0	15.2	17.3
20	10.8	13.0	15.2	17.3	19.5	21.7
30	15.2	17.3	19.5	21.7	23.8	26.0
40	19.5	21.6	23.8	26.0	28.1	30.3
50	23.8	26.0	28.1	30.3	32.5	34.6
75	34.6	36.8	39.0	41.1	43.3	45.5

**GROUTING MATERIAL SUITABILITY**

	Heavy Enough to Overcome Hydrostatic Pressure	<b>NOT</b> Heavy Enough to Overcome Hydrostatic Pressure
	Neat Cement with weight additives	Neat Cement @ 15 lb/gal All Bentonite Grout
	Neat Cement @ 15 lb/gal	All Bentonite Grout
	Neat Cement @ 15 lb/gal or Bentonite Grout @ $\geq 10.4$ lb/gal	Bentonite Grout @ $< 10.4$ lb/gal
	All standard grouts have enough weight to overcome hydrostatic pressure of the flow	

# Borehole Sealing Update

 **QUESTIONS?**

