

APPENDIX B-- Shippensburg Region Geologic Formations

Six separate geologic formations are found in the Borough of Shippensburg: Rockdale Run, Stonehenge, St. Paul Group, Shadygrove, Zullinger, and Elbrook. The most prevalent is the Rockdale Run Formation located in the northwestern portion of the Borough. The remaining formations, with the exception of the St. Paul Group, underlie approximately equal portions of the Borough. The St. Paul Group is the smallest geologic formation in the Borough. The Shippensburg fault is located in the southern portion of the Borough and Township lines. The fault crosses the Borough and the Township in an east to west direction (and thus divides the Elbrook Formation from the remaining formations). The descriptions of these formations were taken from the book Engineering Characteristics of the Rock of Pennsylvania, by Alan R. Geyer and J. Peter Wilshusen from the Pennsylvania Geological Survey.

Porosity - the quality of being porous, full or abounding in pores. The porosity of rocks is the ratio or percentage of the total volume of the pore spaces (minute interstices through which liquids or gases can pass) in relation to the total volume of the rock. Sand, gravel, sandstones, with open textures and coarse grains, are typical porous rocks. Porosity is quite different from perviousness. Dry clay, for example, is highly porous and will hold much water in its pores, but when saturated the small spaces between the grains become blocked with water held by surface tension, preventing the passage of water. To be an aquifer, or source of water, a rock must be both porous and pervious. Porosity may be increased by leaching or decreased by compaction.

Permeability - is capable of being wholly penetrated by a fluid, of allowing the passage of a fluid, of being saturated. The opposite condition is termed "impermeable".

Permeable Rock - a rock that allows the free passage of water through it, such as sandstone. Some geologists also include rock with joints, bedding plans, cracks, fissures, etc. that allow the free passage of water, defining the porous rock as being of primary permeability and the rock with joints, etc. of secondary permeability. Other geologists distinguish the secondary group as being pervious.

ROCKDALE RUN FORMATION:

Description: Very light gray, finely laminated, fine-grained limestone; pink to brown lenses of chert; a few dolomite beds; white quartz rosettes near top of formation; and is estimated to be 2,000 to 2,500 feet thick.

Bedding: Medium bedded in lower third of formation; thick bedded in upper two thirds.

Fracturing: Joints have a blocky pattern; moderately well developed; moderately abundant; regularly spaced; moderate distance between fractures; open and steeply dipping.

Weathering: Moderately resistant; moderately weathered to a deep depth; irregular and block-shaped fragments result from prolonged weathering; interface between bedrock and mantle is characterized by pinnacles.

Topography: Rolling lowland; natural slopes are gentle and stable.

Drainage: Good subsurface drainage; little surface drainage.

Porosity and Permeability: Fractures and solution channels provide a secondary porosity of moderate to high magnitude; low to moderate permeability.

Groundwater: Yields range from in excess of 1,000 gal/min to 45 gal/min in 75 % of all wells drilled; good for public supplies. The CFJMA Act 537 Plan identifies this formation to have a calculated median sustained yield of 32 gal/min. Calculated maximum sustained yield is 220 gal/min. About 25% of wells require standby storage to supply minimum domestic needs.

Ease of Excavation: Difficult; bedrock pinnacles may be a problem; chert and quartz lenses may slow the fast drilling rate.

Cut-slope Stability: Good; should be investigated for solution openings and local intense pinnacle development.

Construction Materials: Good source of coarse aggregate, agricultural lime, and building stone.

STONEHENGE FORMATION:

Description: Gray, finely crystalline limestone and dark-gray laminated limestone; contains numerous flat-pebble breccia beds and shaly interbeds with a maximum thickness of 1,500 feet.

Bedding: Moderately well to well bedded and is thin to flaggy.

Fracturing: Joints have a seamy pattern; well developed to poorly developed; moderately abundant; moderate distance between fractures; open a steeply dipping to vertical.

Weathering: Moderately resistant; slightly weathered to shallow depth; small-to-medium-sized, flat rectangular fragments result; overlying mantle varies in thickness; and is greater than 80 feet thick in places; bedrock pinnacles are characteristic.

Topography: Rolling valleys of low relief with gentle and stable slopes.

Drainage: Good subsurface drainage and sinkholes are characteristic.

Porosity and Permeability: Joint and solution-channel openings provide a secondary porosity of low to moderate magnitude; high permeability.

Groundwater: Median yield is 100 gal/min in most areas. Highest yields are obtained from fractures and solution cavities and water is relatively hard. The CFJMA Act 537 Plan identifies this formation to have a calculated median sustained yield of 138 gal/min. Calculated maximum sustained yield is 500 gal/min.

Ease of Excavation: Difficult; bedrock pinnacles are special problem; fast drilling rate.

Cut-slope Stability: Mostly good; only fair where severely fractured.

Foundation Stability: Good, should be excavated to sound bedrock and thoroughly investigated for solution openings.

Construction Materials: Good source of road material, riprap, building stone, flagstone, embankment facing, and random fill.

ST. PAUL GROUP:

Description: Buff-colored, magnesium limestone containing numerous layers of chert; high-calcium limestone in part; 580 thick at reference section in the northwest corner of the Mechanicsburg Naval Supply Depot, Cumberland County.

Bedding: It is well bedded with a range of beds, some are fissile to flaggy and few are thick bedded.

Fracturing: Most joints have a blocky pattern; some have a platy pattern; moderately well developed; moderately to highly abundant; fairly regularly spaced, having a moderate distance between fractures; most fractures are open, but some are filled with calcite; steeply dipping to vertical in orientation.

Weathering: It is moderately resistant to weathering and is slightly weathered to a shallow depth; medium sized blocks commonly result; overlying mantle is moderately thick; bedrock-mantle interface is characterized by pinnacles in most places.

Topography: Rolling valley of low relief; natural slopes are gentle and stable.

Drainage: There is good subsurface drainage but poor surface drainage and sinkholes are common.

Porosity and Permeability: Joint and solution openings provide a secondary porosity of moderate to high magnitude. It has high permeability.

Groundwater: The median yield is 25 gal/min and some wells encounter solution openings and have very large yields, however; the water is relatively hard. The CFJMA Act 537 Plan identifies this formation to have a calculated median sustained yield of 15 gal/min. Calculated maximum yield is 160 gal/min. About 30% of wells require standby storage to supply minimum domestic needs.

Excavation: The ease of excavation is difficult and the bedrock pinnacles are of special problem. There is a moderate drilling rate.

Cut-Slope Stability: The cut-slope stability is good with steeply dipping beds inclined toward the roadway require moderate to gentle cuts.

Foundation Stability: The foundation stability is good and should be excavated to sound material and should be thoroughly investigated for possible solution cavities.

Construction Materials: This formation is a good source of road materials and fill. It may be high in calcium and suitable for fluxstone.

SHADYGROVE FORMATION:

Description: Light-gray to pinkish-gray, finely crystalline limestone; fossiliferous; abundant nodules of brown chert; few sandstone beds; few beds of laminated dolomite; estimated maximum thickness of 1,000 feet.

Bedding: Well bedded; thick to massive.

Fracturing: Joints have a blocky pattern; moderately well developed; moderately abundant; regularly spaced, having a moderate distance between fractures; open and steeply dipping.

Weathering: Moderately resistant; slightly to moderately weathered to a shallow depth; irregularly shaped to medium-sized blocks result from long-term weathering; pinnacle interface between bedrock and soil.

Topography: Gently rolling lowlands; natural slopes are gentle and stable.

Drainage: Good subsurface drainage; little surface drainage.

Porosity and Permeability: Joint openings and solution channels create a secondary porosity; low-magnitude porosity and permeability.

Groundwater: The CFJMA Act 537 Plan identifies this formation to have a calculated median sustained yield is 68 gal/min. Calculated maximum sustained yield is 240 gal/min. About 20% of wells require standby storage to supply minimum domestic needs. Water is relatively hard.

Ease of Excavation: Difficult; bedrock pinnacles are a special problem; think sandstone interbeds and chert nodules slow the drilling rate.

Cut-slope Stability: Good; maintains nearly vertical cuts.

Foundation Stability: Good; should be thoroughly investigated for caverns.

Construction Materials: Good source of fill.

ZULLINGER FORMATION:

Description: Interbanded medium-gray limestone and dolomite; interlaminated limestone and dolomite; think dolomite; local think quartzsand beds; probably 2,500 feet thick.

Bedding: Well bedded; thick to massive.

Fracturing: Joints have a blocky pattern; moderately well developed; moderately to highly abundant; regularly spaced, having a moderate distance between fractures; open and steeply dipping.

Weathering: Moderately resistant; slightly to moderately weathered to a shallow depth; irregularly shaped, medium-sized blocks result from prolonged weathering; interface between bedrock and soils is characterized by pinnacles in most places.

Topography: Rolling valley of low relief; natural slopes are gentle and stable.

Drainage: Good subsurface drainage; little surface drainage.

Porosity and Permeability: Solution channels provide a moderate secondary porosity; moderate to high permeability.

Groundwater: Calculated median sustained yield is 82 gal/min.; yielding zones are evenly distributed through the upper 450 feet of bedrock; water is relatively hard. The CFJMA Act 537 Plan identifies this formation to have a calculated median sustained yield is 40 gal/min. Calculated maximum sustained is 390 gal/min. About 15% of wells require standby storage to supply minimum domestic needs.

Ease of Excavation: Difficult; bedrock pinnacles are a special problem. It has a fast drilling rate, however; the quartz-sand beds have a slow drilling rate.

Cut-slope Stability: Fair to good.

Foundation Stability: Good, thorough investigation for solution cavities should be undertaken.

Construction Materials: Good source of road material, riprap, embankment facing, fill and aggregate.

ELBROOK FORMATION:

Description: Light-gray to yellowish-gray, finely laminated, siliceous limestone having interbeds of dolomite; cherty; thickness is about 3,000 feet.

Bedding: Well bedded; mostly thick, but flaggy and massive beds also occur.

Fracturing: Joint pattern is irregular and moderately developed; joints are moderately abundant and irregularly spaced, having a wide to moderate distance between fractures; most are open but some are filled with quartz and calcite; steeply dipping.

Weathering: Moderately resistant; moderate weathering to a shallow depth; small, flat fragments ranging to large boulders result; the overlying mantle is thought to be moderately deep; bedrock-mantle interface is characterized by pinnacles.

Topography: Rolling valley of low relief; natural slopes are gentle and stable.

Drainage: Good subsurface drainage; little surface drainage.

Porosity and Permeability: Solution channels provide a secondary porosity of moderate magnitude; moderate to high permeability.

Groundwater: Median yield is 30 gal/min in most areas. The CFJMA Act 537 Plan identifies this formation to have a calculated median yield is 250 gal/min. Maximum reported yield is 250 gal/min. About 15% of wells require standby storage to supply minimum domestic needs.

Ease of Excavation: Difficult; bedrock pinnacles are special problem; fast drilling rate; locally, chert slows the drilling rate.

Cut-slope Stability: Good.

Foundation Stability: Good, thorough investigation for sinkholes and pinnacle bedrock surface should be undertaken.

Construction Materials: Good source of road material, riprap, and fill.