Table 2.1-1 Geologic Properties of the Chesapeake Basin

Geologic Properties

PERIOD	Quaternary					Tertiary								Cretaceous						
EPOCH (Years before present)	Holocene (0 to 10,000)	Pleistocene (10,000 to 1.6 million)				Pliocene (1.6 to 5.3 million)		Miocene (5.3 to 23.7 million)				Eocene (36.6 to 57.8 million)			Paleocene (57.8 to 66.4 million)	Upper Cretaceous (66.4 to 97.5 million)				Lower Cretaceous (97.5 to 144 million)
FORMATION (symbol) *Dashed Line Indicates Unconformity*	Holocene Deposits (Qal, Qsw, Qm, Qub)	Nanticoke Deposits (Qn)	Omar (Qomu, Qomf)	Staytonville (Qsu)	Columbia (Qcl)	Walston Silt (Tw)	Beaverdam (Tbd)	Bethany (Tbt)	Manokin (Tm)	Chesapeake Group (Tcg) Saint Marys (Tsm)	Choptank (Tch)	Calvert (Tc)	Piney Point (Tpp)	Nanjemoy (Tna)	Rancocas Group (Trng) Vincentown (Tvt)	Hornerstown (Thl)	Mount Laurel (Kml)	Matawan Group (Kmag) Marshalltown (Kmt)	Englishtown (Ket)	Merchantville (Kmv)	Magothy (Km)	Potomac (Kpt)
DOMINANT LITHOLOGY fg = fine grained vf = very fine f = fine m = medium c = coarse v = varigated ws = well sorted ps = poorly sorted	Qal = alluvial deposits Qsw = swamp deposits Qm = marsh deposits Qub = upland bog deposits These four deposits have been mapped in the Seaford area and are representative of other Holocene deposits that have accumulated and are accumulating in other areas on the basin. These deposits are generally characterized by dark, organic, rich fg sediments of sand, silts, and clays.	Textures range from f - m quartz sand to sandy clayey silt. Colors of units range from brown to light gray. Contains rare beds of gravelly c to m sand and shelly sandy silt.	Most dominant texture is sand. Two units; Upper unit - Qomu white to bluish gray sand, silt, clay and scattered shell beds. Lower unit - Qomf. Color is same as for Qomu, is a vf sand to clayey silt and silty clay.	Tan to light to dark gray clayey and silty sand and sandy silt	Reddish orange, light gray to white, brown to tan, feldspathic, m to c sand. Contains gravel and light gray silt beds.	Weathered upper portion is an orange brown or mottled red and white clay and silt. Unweathered lower portion of formation is greenish gray and dark gray, pc clayey sand beds are interstratified within the Fm.	Contains two lithofacies. Upper unit - Yellow-orange, light brown and light gray, quartzose f to m sand, sandy silt and clayey silt with white to light yellow silt and clay matrix. Also contains rare beds of dark gray to brown organic rich clayey silt. The lower unit is coarser and contains light gray to yellow-orange, m to c sand, gravelly sand and sandy gravel. Also contains rare beds of gray, blue, or green gray clay and silt. Rare cobbles and boulders are found in lower unit. Bright white, red and orange colors signify the weathered portion of the Fm.	Bethany (Tbt)	Manokin (Tm)	Saint Marys (Tsm)	Choptank (Tch)	Calvert (Tc)	Piney Point (Tpp)	Nanjemoy (Tna)	Vincentown (Tvt)	Hornerstown (Thl)	Mount Laurel (Kml)	Marshalltown (Kmt)	Englishtown (Ket)	Merchantville (Kmv)	Magothy (Km)	Potomac (Kpt)
DEPOSITIONAL ENVIRONMENT T = Transgression R = Regression TC = Terrigenous Clastic	Are generally alluvial and fluvial deposits deposited in and along streams, channels, and flood plain (T)	Fluvial to estuarine depositional environment and reworked by aeolian processes. Likely several transgressive and regressive cycles occurred during the Fm. of the unit (T&R)	Deposited in an estuarine environment under several transgressive and regressive cycles (T&R)	Probable estuarine origin (T)	Fluvial deposits laid down by glacial streams (TC)	Likely deposited in a salt marsh or as a barrier to barrier system (T)	Upper unit was deposited on a delta plain. Lower unit was deposited in a fluvial setting (T&R)	A deltaic deposit. (R)	Shallow marine to delta front. (R)	Shallow marine to delta front. (R)	Shallow marine to delta front. (R)	Marine deposits. Basal silts deposited on outer shelf. Basal sandbeds deposited on inner shelf. Upper sands represent shallow marine environment deposited by prograding deltas. (T&R)	Marine, shelf environment. (R)	Marine, inner shelf environment (T)	Marine, inner, open shelf deposits Deposited in water <600' deep (R)	Marine, inner shelf deposits deposited in waters <600' deep (R)	Marine shelf deposits. Deposited in waters <600' deep. (R)	Marine shelf deposits. Deposited in waters <600' deep (T)	Marine shelf deposits deposited in waters <600' deep (R)	Marine shelf deposits. Deposited in waters <600' deep (T)	Tide dominated near shore marine or estuarine deposits. (T)	Fluvial, channel/flood plain deposits. Nonmarine. (TC)
RESOURCE VALUE	Limited, may be useful as a lightweight aggregate. Unit may also result in additional attenuation of ground-water contaminants if ground-water contaminated with nutrients and metals pass through it	Possible use as borrow for construction. In certain areas form excellent recharge areas. Also provides baseflow in streams	May be fine grained enough to serve as surficial confining unit especially where Qomi is present.- May serve as a dentrifying unit where fine-grained and organic.	Surficial confining clay in the Harrington and Greenwood area.	Forms the most extensive unconfined aquifer system in the basin. Contributes large quantities of water to streams through baseflow. Serves as a major sand and gravel resource.	May serve as a shallow local confining layer in an area east of Delmar in the vicinity of the state line.	Historically mined for bog iron. Bog iron dredged from bogs from 1760 until early 1800s. Commonly mined for sand/gravel in Sussex. Contains a prolific heavily used aquifer in Sussex County. Baseflow from this aquifer contributes as much as 75% of the stream discharge in the Sussex portion of the basin.	Minor aquifer where coarse enough. Likely is in hydrologic connection with the overlying Beaverdam.	Is part of the unconfined aquifer where unit B subcrops the Beaverdam Fm. Unit B is present and continuous throughout the Manokin subcrop area	Primarily serves as a regional confining layer in Sussex County.	Shelly/sandy units form aquifers. Becomes useful as an aquifer likely between Felton and Harrington – and south to about Laurel.	Sandbeds form several major aquifers in area between Smyrna and Harrington.	Major aquifer in central Kent County, DE.	Primarily a confining unit.	Along with underlying Hornestown Fm. forms a major aquifer in the Middletown to Townsend area	Along with overlying Vincetown Fm. forms a major aquifer in the Middletown to Townsend area. Also mined for Potassium (K) and has potential for remediating contaminated materials and able to remove heavy metals	Aquifer in Middletown area and in the subcrop area to the north of middletown.	Acts as leaky confining unit.	Minor aquifer	Acts as leaky confining unit.	An aquifer utilized in the C & D Canal area. Used primarily for domestic water supplies.	Major aquifer in and north of Middletown. Has been mined commercially as a clay resource. Also serves as a major confining layer throughout the basin.
AQUIFER EQUIVALENT N/A = not applicable	N/A	N/A	N/A	N/A	Columbia, water table or unconfined aquifer	N/A	Beaverdam or unconfined aquifer	Unconfined or water table aquifer.	Manokin	May contain minor Miocene aquifers.	Choptank	Frederica(upper sand)/Federalsburg (middle sand)/Chesw old (lower sand)	Piney Point	N/A	Rancocas	Rancocas	Mount Laurel	N/A	Englishtown	N/A	Magothy	Potomac
PROPERTIES OR FACTS *(References - see key)*	Within the basin, the most substantial Holocene deposition occurs along the Nanticoke River and its tributaries. *(3)*	The Nanticoke deposits were formed during cycles of erosion and deposition in response to Pleistocene glacial/interglacial cycles. Is commonly capped by well sorted f to m sand within dunes occurring primarily on southeast side of Nanticoke River. The unit is found along the Nanticoke and its tributaries. May be up to 25' thick and is often associated with excellent recharge areas. *(3)*	This Formation makes up a negligible percentage of the Chesapeake Basin sediments and occurs along the extreme southeastern portion of basin. Unconformably overlies the Beaverdam Fm. The total thickness of this unit within the basin is likely <25' thick. Contains an organic carbon-rich facies. Lower Omar deposited in a paleovalley possibly during the Pliocene. Lithological changes occur very rapidly both vertically and laterally. Deposition spanned both glacial and interglacial periods. *(28)*	12' to 18' thick in well NC 13-3. Mottled texture. *(28,35)*	High energy glacial streams cut deep into the subcropping Fms during low sea level stands forming several paleo channels that occur throughout the basin. Fluvial sediments of the Columbia Fm. later infilled these valleys and now forms productive unconfined aquifers. *(28)*	Is a surficial unit that unconformably overlies the Beaverdam. May attain a thickness of about 40'. Is deeply weathered indicating a relatively old unit. 2" diameter cherts are found at the contact with Beaverdam Fm. *(28)*	Unconformably overlies the St. Mary's Fm. Is very susceptible to contamination from anthropogenic sources. Serves as an infiltrative medium that captures precipitation and allows ground-water recharge to deeper aquifers. Is exposed at the surface, susceptible to erosion and is a major sediment source for surrounding streams. *(1,3,10,29)*	Subcrops the Beaverdam Fm. Is difficult to distinguish between underlying Manokin Fm. *(28)*	Lower uni, where present, lies conformably on the St. Marys Fm. Upper unit is often weathered and is unconformably overlain by the Beaverdam Fm. north of Laurel. Location of unit is structurally controlled by faulting. *(3,28)*	The location of unit is structurally controlled by faulting. *(3,28)*	Is characterized by as many as three upward fining sequences. *(3,6)*	Sandy silt bodies form regional confining layers. The Choptank/Calvert boundary is identified by a granular to coarse sand of Choptank overlaying a distinctive brown silty clay at top of Calvert. *(24,27,40)*	Does not directly subcrop surficial units. Top of the unit generally occurs at depths >250' BGS *(24,25)*	The Nanjemoy does not directly subcrop the surficial sediments *(25,26)*	Becomes indiscernible and grades into Pamunkey Fm. (Tkpa) between Smyrna and Townsend. The Tkpa is primarily fg and was deposited in deeper waters of outer shelf and inner slope. In 1800's mined in Middletown area. Used on farm fields to supply Potassium (K). Has potential (due to high cation exchange capacities) as a purifying filter for wastewater, etc. *(10,24,25,26,29,36)*	Becomes indiscernible and grades into Pamunkey Fm. between Smyrna and Townsend. The Cretaceous/Tertiary boundary occurs in the lowest of the three gamma peaks that characterize the bottom portion of the Hornerstown. Rancocas group is up to 50% to 90% glauconite by weight. 75 active green sand pits operating in the St. Georges to Odessa area in 1840. *(10,24,25,26,29,36)*	Known as the Monmouth Fm. Downdip. Is abundantly fossiliferous in some areas. More calcareous than glauconitic. Sometimes the Mount Laurel Fm. and underlying Englishtown Fm. are considered one aquifer. *(24,30,36)*	Belongs to the Matawan Group, however, individual Fms. become indistinguishable south of Middletown. *(30)*	Belongs to the Matawan Group (Kmag). Individual Fms. become indistinguishable south of Middletown *(1,2,16)*	Belongs to the Matawan Group, however, individual Fms. become indistinguishable south of Middletown. *(37)*	Persistent laterally throughout Coastal Plain. Sharp left kick on gamma log. *(24,37)*	Forms 75% of coastal plain sediment volume. Sand beds hard to trace laterally. May outcrop in north part of basin Possible stream interaction around north of C & D Canal *(1,2)*

Reference Key - **1)** *Andres, 1994* **2)** *Andres, 1986* **3)** *Andres and Ramsey, 1995* **10)** *Doyle and others, 1981* **16)** *Johnston, 1976* **20)** *Owens and others, 1979* **24)** *Pickett and others, 1983* **25)** *Pickett and others, 1977* **26)** *Pickett and others, 1971* **27)** *Ramsey, 1993* **28)** *Ramsey and Schneck, 1990* **29)** *Saundstrum and others, 1975* **30)** *Sheridan and Grow, 1988* **35)** *Talley, 1975* **36)** *Woodruff, 1990* **37)** *Woodruff, 1986* **40)** *Woodruff, 1970*