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Vocabulary – Groundwater Conceptual Site Model

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Vocabulary of Groundwater Conceptual Site Model

Ancestral Tennessee River – the river system in the area of PGDP during the Pliocene-to-Pleistocene period, when sediments of the UCRS and RGA were deposited.

Porters Creek Clay Terrace – the common reference to the now-buried terrace slope that formed as the steep, south bank of the ancestral Tennessee River. The buried terrace slope underlies the south end of the industrial area of PGDP and is the southern limit of the RGA. At the terrace slope, low-permeability silts of the Porters Creek Clay Formation (to the south) are juxtaposed with Lower Continental Deposits/RGA (to the north).

Terrace Gravel – the Older Pliocene gravel deposits located to the south of the Porters Creek Clay Terrace slope. Shallow, unconfined groundwater systems are developed in the Terrace Gravel, which overlies the Porter Creek Clay Formation south of the Porters Creek Clay Terrace slope.

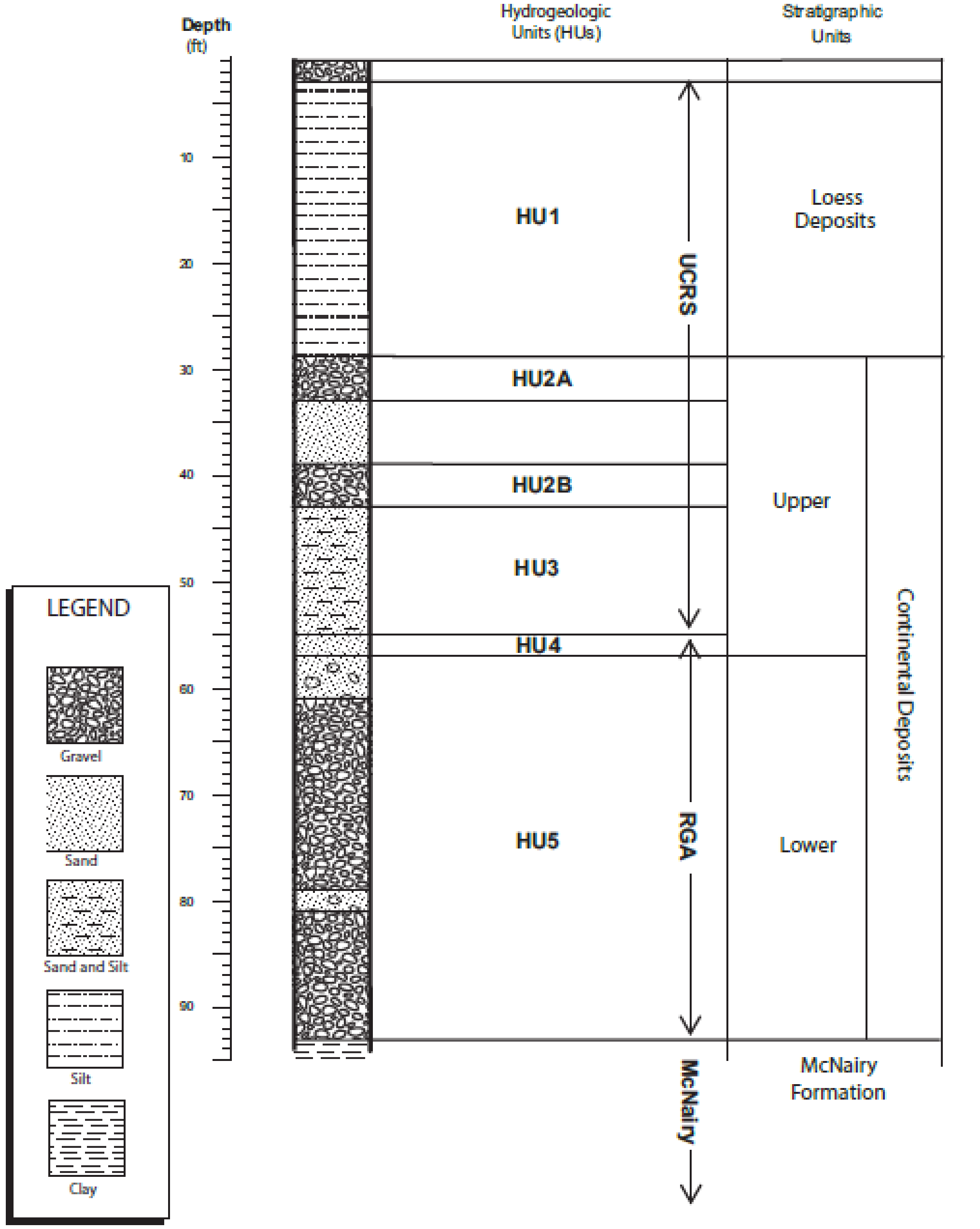
UCRS – the uppermost water bearing unit, where infiltration of water from the surface occurs and where the uppermost zone of saturation exists, is called the Upper Continental Recharge System.

Groundwater flow in the Upper Continental Deposits is primarily downward. Hydraulic gradients generally range from 0.5 to 1 ft/ft, vertically. While groundwater flow is predominantly downward, there is some lateral flow due to heterogeneities in the shallow soils.

The UCRS is a conduit of recharge to the underlying RGA.

> **HU1 –** the upper member of the UCRS, consisting of loess (wind-deposited silt associated with glacial periods), disturbed soils, and fill material. The HU1 is commonly 15-to-20 ft thick beneath C-400 and is unsaturated.
>
> **HU2 –** the middle member of the UCRS, consisting of a horizon of common sand and gravel bodies in a loess matrix –alluvial fan deposits derived from the gravels on the nearby Porters Creek Clay terrace. The sands and gravel bodies are moderately connected beneath C-400 and thin and disappear to the north (away from the terrace). Two members (two periods of alluvial fan development) are recognized beneath C-400: the upper **HU2A member** occurs within the approximate elevations 348 to 360 ft amsl and the lower **HU2B member** occurs within the approximate elevations 338 to 348 ft amsl. Sands and gravels of the HU2 are typically unsaturated beneath C-400 but may be episodically saturated following significant precipitation events.
>
> **HU3 -** the lower member of the UCRS, consisting of a thick sequence of predominately silt and fine sand deposits of lacustrine origin occurring below HU2. Conceptually, the base of HU3 is the lowest interval of predominately vertical groundwater flow, commonly anticipated in the field as the lowest silt interval above the Regional Gravel Aquifer. In practice, HU3 silts grade into HU4 sands in many places.

RGA – the lateral groundwater flow system under the PGDP, developed in the basal sand member of the Upper Continental Deposits and the thick gravel member of the Lower Continental Deposits is called the Regional Gravel Aquifer.



U.S. DEPARTMENT OF ENERGY
DOE PORTSMOUTH/PADUCAH PROJECT OFFICE
PADUCAH GASEOUS DIFFUSION PLANT

Stratigraphic and Hydrogeologic Units in Soil Boring H-007 of South C-400 Area

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Horizontal flow predominates: hydraulic gradients commonly range between 10^{-3} and 10^{-4} ft/ft northward. Vertical gradients are approximately 10^{-4} ft/ft downward. Hydraulic conductivity of the RGA (ranging from 53 ft/day to 5,700 ft/day) is commonly 10^4 X greater than that of the UCRS and commonly 10^3 to 10^5 X greater than that of the underlying McNairy Formation. The RGA is a semi-confined aquifer.

The RGA is the shallow aquifer underlying PGDP, conveying water northward to the Ohio River. Ambient groundwater flow rates in higher conductivity corridors within the RGA commonly range from 1 to 3 ft/day.

The base of the RGA occurs at an approximate elevation of 290 ft amsl.

> **HU4 –** where present, an upper fine-to-medium-grained sand member of the RGA: also the lowest depositional unit of the Upper Continental Deposits. Conceptually, the uppermost interval of significantly horizontal groundwater flow in the RGA. The HU4 is commonly 1-to-5 ft thick but can be over 10 ft thick and is commonly recognized in the field as sand with no gravel present.
>
> **HU5 –** the main member of the RGA, a thick gravelly deposit of the ancestral Tennessee River. The texture is commonly homogenous gravelly sand to sandy gravel with occasional sand lenses. The HU5 has a thickness of approximately 25-to-35 ft beneath C-400.

McNairy – the groundwater flow system in the (typically) fine sand and silt matrix of the McNairy Formation: identified as HU6 in the site-wide groundwater flow model.

Groundwater flow is laterally northward to the Ohio River, with a slightly lesser gradient than that of the RGA. Hydraulic potential within the McNairy is typically lower than that of the RGA beneath C-400 but becomes greater than that of the RGA near the Ohio River: a minor vector of groundwater flow is downward, into the McNairy, beneath C-400 and upward, into the RGA, near the Ohio River. Hydraulic conductivity of the McNairy Formation averages approximately 2 E-02 ft/day laterally and 4.4 E-04 ft/day vertically.

The McNairy Formation is considered the basal aquitard to the Regional Gravel Aquifer.

The McNairy Formation contains a regionally extensive, middle member of generally finer-grained sediments (silts and clays) called the Levings Member. At C-400, the top of the Levings Member is evident in soil boring logs of 400-040 (at approximate elevation 214 ft amsl) and in 400-041 (at approximate elevation 205.5 ft amsl).