Technical Basis for the Location and Screen Interval of Groundwater Monitor Wells at Cabot Performance Materials Corporation Boyertown, Pennsylvania Plant

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August 9, 2002

1. INTRODUCTION

This evaluation of the groundwater monitoring wells at the Cabot Performance Materials Corporation (CPM), Boyertown, Pennsylvania, Plant is provided in response to the Nuclear Regulatory Commission's (NRC) Request for Additional Information concerning renewal of NRC Source Material License SM-920 for the plant. In particular, this evaluation responds to item 6 of the Request for Additional Information, which is entitled "Groundwater Monitoring Well Locations."

The adequacy of the location and screen intervals of the groundwater monitoring well network can be justified when placed in the context of the local groundwater system. This evaluation includes a brief discussion of groundwater flow near the bulk storage bins (based on a conceptual groundwater flow model refined during 2000) and a suggested monitoring well network for future compliance monitoring.

2. GROUNDWATER CONCEPTUAL MODEL

Groundwater flow near the bulk storage bins is influenced by an igneous intrusive diabase system north of the plant property that is resistant to weathering and that is responsible for creating the upland hills northeast of Township Line Road, as shown in Figure 1. Soils overlying the diabase are of very limited thickness, and the diabase has few, if any, significant fractures for the vertical transmission of groundwater. In fact, water wells drilled in Triassic diabase intrusive systems in southeast Pennsylvania produce little, if any, water. Groundwater produced in the diabase is typically from very few sparsely distributed fractures.

The few fractures and limited soil cover of the diabase result in a relatively significant shallow/surface water run-off system during precipitation events. This precipitation develops into a naturally occurring near-surface stormwater run-off system that is interpreted to result in the rapid and forceful recharge (infiltration) of water at the nearest "more permeable" geologic formation. In the northern plant area near the bulk storage bins, this recharge area is in the immediate vicinity of Township Line Road at the Brunswick Formation-Triassic diabase contact. This rapid infiltration at the Brunswick Formation contact is interpreted to create a significant vertical pressure head and an equally significant pressure head in the lateral downgradient direction (south-southwest).

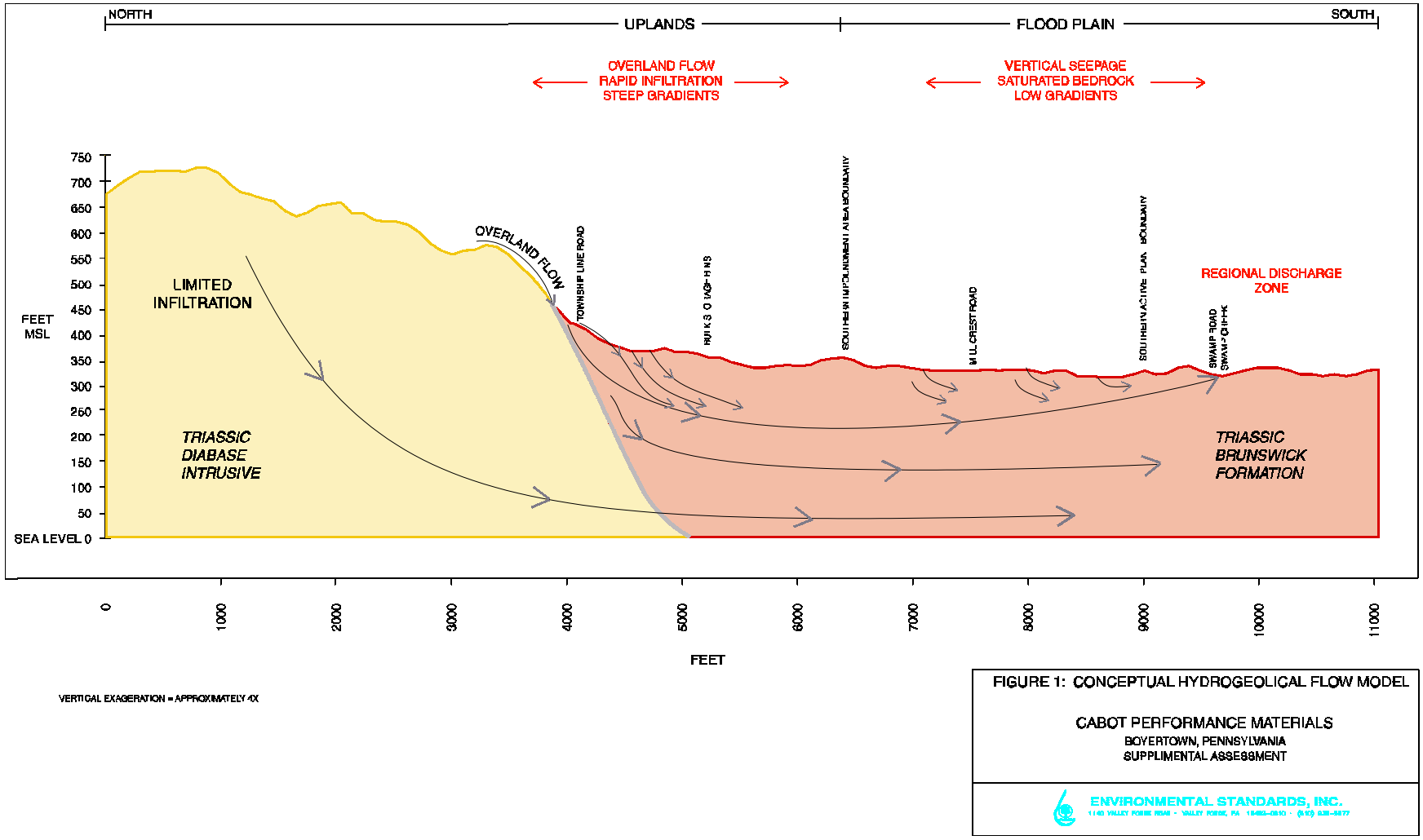

Figure 1: Conceptual Hydrogeological Flow Model

Once surface water run-off from the diabase uplands penetrates the Brunswick Formation underlying the bulk storage bins, fractures influence and control groundwater flow. As shown in Figure 1, recharge from the diabase uplands underflows the bulk storage bins, ultimately continuing to move in a south-southwesterly direction to West Swamp Creek (the regional groundwater discharge boundary to the west of the plant).

3. PROPOSED GROUNDWATER MONITORING WELL NETWORK

Using the recently refined conceptual groundwater flow model, CPM proposes to modify the existing groundwater monitoring well compliance network, as detailed in Table 1. The proposed and existing monitoring well network is shown in Figure 2. CPM proposes to monitor groundwater at seven locations; six existing groundwater monitoring wells (MMW-1, MMW-2, MMW-3, MMW-4, MMW-5, and Well 1A) will no longer be used for monitoring purposes. The MMW wells are installed immediately adjacent to the bulk storage bins, and may not be optimally placed to detect potential material storage effects on groundwater quality in the vicinity of the bulk storage bins (based on the revised conceptual model). The wells may be too close to account for dispersive effects and fracture flow characteristics. Similarly, Well 1A may be positioned hydraulically cross-gradient of the primary groundwater flow path for optimum use.

The six wells cited above will be replaced by four existing groundwater monitoring wells (MW 95-01, MW 95-03, MW 95-04, and MW 97-06) that were originally installed as part of a voluntary Pennsylvania Residual Waste program compliance monitoring program (administered by the Pennsylvania Department of Environmental Protection [PA DEP]). Each of the four wells is fitted with dedicated sampling systems that are identical to those found in the currently used wells (e.g., “Well Wizards”).

Groundwater monitoring well MW 95-01 (which has not been used for compliance monitoring in the past) occupies the most upgradient position of any monitoring well at the plant. This well intercepts a regional water-producing fracture from 40 to 60 feet below grade. Data from this well will be used to characterize “background water quality” with respect to this monitoring program.

Table 1. Groundwater Monitoring Well Construction Specifications for Cabot Performance Materials Boyertown, Pennsylvania Plant

Well Identification	Top of Casing (1)	Total Depth (2)	Surface Casing (2)	Screened/ Open Interval (2)	Top Sand Pack (2)	Bentonite Seal Interval (2)	Top Bedrock (2)	Observed Water Producing Zones (2)	Current Monitoring Well Purpose or Regulatory Program	Proposed Monitoring Well Purpose or Regulatory Program
MW 95-01	360.07	60	7	60-30	26.5	26.5-24	2	26, 40-60	PA DEP Residual Waste Program	NRC License Monitoring
MW 95-03	333.01	38	13	28-38	26	26-24	7	24, 37	PA DEP Residual Waste Program	NRC License Monitoring
MW 95-04	329.99	60	9	60-40	37	37-34	4	22, 45	PA DEP Residual Waste Program	NRC License Monitoring
MW 97-06	327.21	94	11	94-74	69	69-63	6	ND	PA DEP Residual Waste Program	NRC License Monitoring
MMW-1	354.43	101	20	73.3-43.3	19.7	19.7-16.5	3	26, 74, 85	NRC Permit Monitoring	None
MMW-2	348.45	101	20	45-75	23	18-23	3	26, 56, 77	NRC Permit Monitoring	None
MMW-3	346.17 (3)	101	20	44.3-74.3	21.7	16.9-21.7	3	34	NRC Permit Monitoring	None
MMW-4	343.50 (3)	101	20	45-75	25.4	18.8-25.4	3	19, 51, 57, 96	NRC Permit Monitoring	None
MMW-5	342.67 (3)	101	20	40-70	20.6	13.6-20.6	2	35, 77	NRC Permit Monitoring	None
Well 1A	ND	405	21	21-405	NA	NA	ND	ND	NRC Permit Monitoring	None
Well 2	ND	528	16	16-528	NA	NA	ND	80, 340, 410, 483, 515	NRC Permit Monitoring	NRC License Monitoring
MW-3	ND	15.6	None	ND	ND	ND	ND	ND	NRC Permit Monitoring	NRC License Monitoring
MW-4	ND	14.5	None	ND	ND	ND	ND	ND	NRC Permit Monitoring	NRC License Monitoring

Notes:
(1) ft MSL - indicates the elevation is measured relative to mean sea level.
(2) All depths referenced to land surface and expressed in feet below ground surface (ft bgs).
(3) The top of casing elevation for this well was measured in 1985 and has not been resurveyed.
NA - Not Applicable; well is completed as an open borehole well and has no sand pack or bentonite seal.
ND - Indicates no data were available on a given well specification.

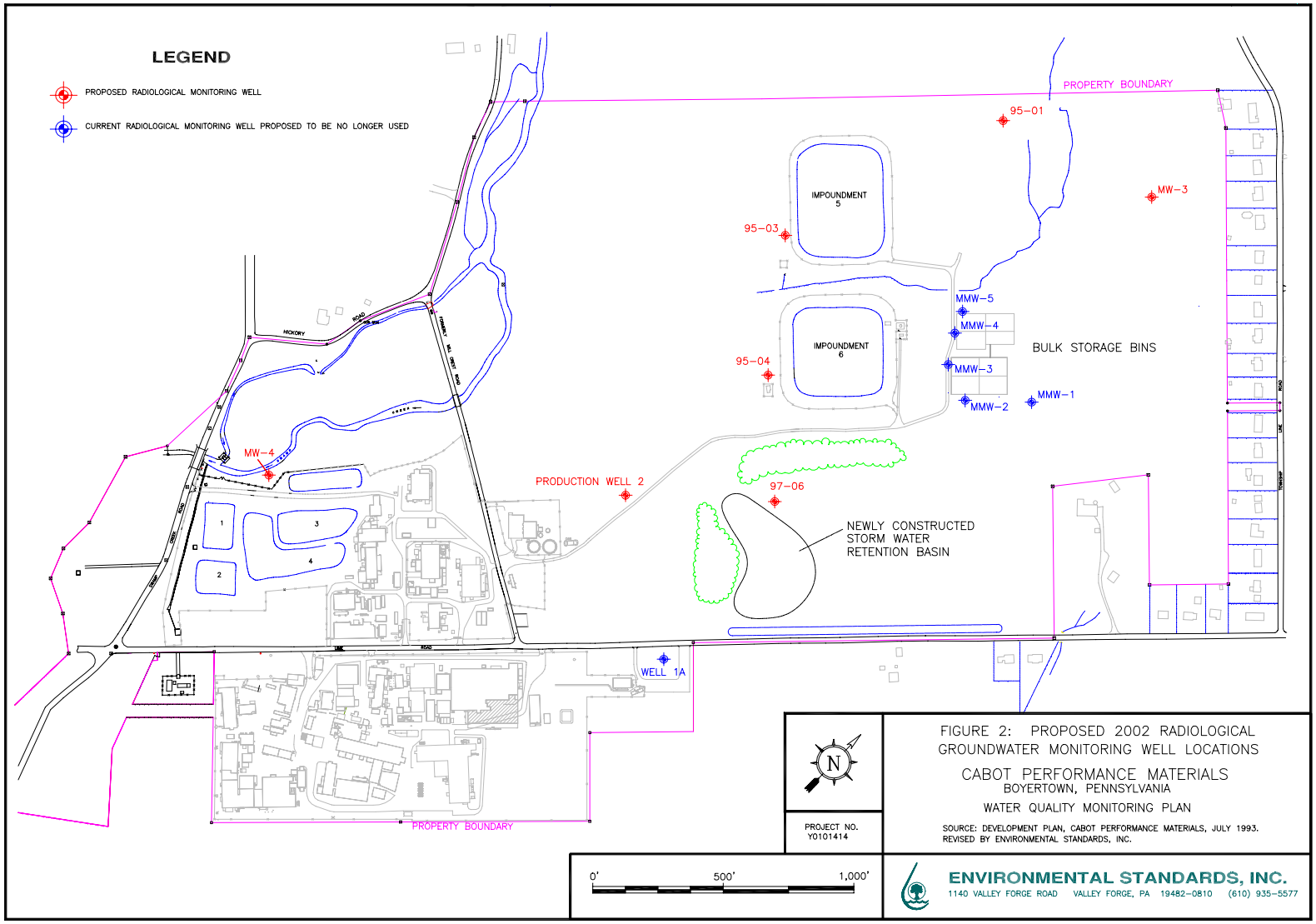

Figure 2: Proposed 2002 Radiological Groundwater Monitoring Well Locations

Groundwater monitoring wells MW 95-03, MW 95-04, and MW 97-06 intercept major groundwater producing fractures in the Brunswick Formation and lie immediately downgradient of the bulk storage bins. These wells, which have not been used for NRC compliance monitoring in the past, are properly positioned to intercept groundwater flowing beneath the bulk storage bins and to evaluate the potential for material storage to have affected groundwater quality.

MW 95-03 lies slightly north of the primary flow path of the bulk storage bins and just north of an interpreted east-west fracture (mimicked to some degree by an ephemeral stream between Impoundments 5 and 6) that controls groundwater flow slightly north of the bulk storage bins. During installation, water-producing fractures were identified in this well at 24 and 37 feet below grade. Samples from this well will provide information regarding the possible movement of bulk storage bin material north of the fracture. While it is currently believed that this fracture acts as an hydraulic barrier to meaningful flow to the north, it will be monitored to verify this belief.

MW 95-04, positioned immediately downgradient of the bulk storage bins, intercepts water-producing fractures at 22 and 45 feet below grade. This well is optimally positioned both vertically and horizontally to evaluate the potential for movement of bulk storage bin material in groundwater downgradient of the bins.

MW 97-06 is positioned downgradient of the bulk storage bins, and no specific water-producing fractures were identified during installation. This well is effectively positioned both vertically and horizontally to evaluate the potential for movement of bulk storage bin material in groundwater downgradient of the bins in a southerly direction. This well was included in the monitoring system because groundwater flow directions have varied slightly over time (10 years of data suggest the horizontal component of flow may be directed more towards MW 97-06 rather than MW 95-04). This well will be used to replace Well 1A, which is not as well positioned for groundwater monitoring.

Certain groundwater wells already in use are proposed for continued monitoring. These wells include Well 2 (a deep production well), monitoring well MW-3, and monitoring well MW-4.

Well 2 is proposed for monitoring because it is the sole plant production well currently in use (fire system water supply) and because of its construction characteristics (an open hole interval of more than 380 feet). This well represents the nearest point of use for groundwater downgradient of the bulk storage bins. In addition, the extended length of the open interval provides an assessment of "overall" groundwater condition in the aquifer downgradient of the bulk storage bin area.

Groundwater monitoring well MW-3 will continue to be used because it is the closest well to any residential properties (albeit the well is hydraulically upgradient of the bulk storage bins). Data from this shallow well will be used as "sentinel" (early warning point) data for the upgradient residents of Township Line Road in the unlikely event that bulk storage bin activities have affected upgradient water quality.

Groundwater monitoring well MW-4 will continue to be used for compliance monitoring because the well reflects downgradient water quality immediately adjacent to groundwater discharge to West Swamp Creek. Data from this shallow well will be used to evaluate water quality prior to discharge into West Swamp Creek.

Upon approval by the NRC of this proposed groundwater monitoring network, Wells 1A, MMW-1, MMW-2, MMW-3, MMW-4, and MMW-5 will be properly abandoned pursuant to PA DEP recommendations and guidelines.