Appendix C

Description of Changes in Modeling Evaluation and Inputs for SED 9

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As discussed in the text of this Work Plan, EPA, has defined SED 9 to include mechanical dredging in the wet in Reaches 5A and 5B, which is different from the assumptions for those reaches under previously evaluated alternatives (i.e., SED 1 through SED 8). Specifically, EPA has requested that GE assume that, in Reaches 5A and 5B, implementation of SED 9 would include mechanical dredging in the wet performed from within the channel. GE will evaluate the feasibility of this approach in the revised CMS Report. However, in the meantime, in order to simulate this alternative, it is necessary to specify production rates and PCB release rates during such dredging that reflect the anticipated impact of these activities and related conditions in those reaches. GE's proposed approach to these inputs is described below.[1]

Production Rates

As described in the CMS Report, an average per crew production rate of 275 cubic yards per day (cy/d) was selected for mechanical removal performed "in the wet." This average annual production rate assumed a schedule of 198 working days per year (i.e., 22 days per month between March and November). This rate was based on dredging in reaches downstream of Reach 5B, where deeper water depths (i.e., greater than 5 feet during normal flow conditions), improved channel access, fewer channel constructions/obstructions and increased barge mobility would make performance of mechanical removal from a barge feasible.[2] For these reaches, therefore, it was assumed that mechanical removal in the wet would be performed using barge-mounted conventional excavation equipment (e.g., long-stick excavators, cranes) with a series of barges used to ferry excavated and backfill materials to and from the associated staging areas. For the purposes of this assessment, it is assumed that, under SED 9, mechanical removal in Reach 5B (where water depths are typically greater than 5 feet) would likewise be

[1] In addition to these changes in model inputs, SED 9 calls for sediment removal and installation of a 1-foot cap in shallow areas of Woods Pond such that an increase in water depth of 2.5 feet is achieved after the placement of the cap – i.e., sediment removal to a depth greater than the thickness of the cap. This element of SED 9 is similar to the Woods Pond element of the Ecologically Sensitive Alternative (ESA) (discussed in Appendix B to this Work Plan) in that it would result in a change to the model bathymetry in Woods Pond. Changes to the model code that are needed for the simulation of this alternative are described, along with the similar changes needed for modeling of the ESA, in Attachment B-1 to Appendix B.

[2] This production rate does not include any effort to avoid or minimize adverse ecological impacts to the Primary Study Area and the species, including state-listed rare species that inhabit it.

performed using barge-mounted equipment similar to that assumed to be used for other downstream reaches.

However, average water depths in Reach 5A (i.e., typically less than 3 to 4 feet) make the use of barges infeasible in that reach. Therefore, to accommodate EPA's definition of SED 9 as involving mechanical removal in the wet from the channel (in order to minimize the need for access roads along the riverbanks), it will, as requested by EPA, be assumed that sediment excavation in Reach 5A would be performed using conventional equipment (e.g., excavators, articulated off-road trucks) operating from the channel bottom, although GE has not fully determined the feasibility of this approach. To facilitate such operations, access ramps providing stable entry to the channel would be constructed. In addition, as necessary to minimize disturbance to the channel bottom and allow for operation in deeper areas, temporary roads would be constructed along the channel bottom. Such temporary roads could consist of gravel placed on the channel bottom, or a series of swamp mats or modular platforms, over which heavy equipment could travel.

Because of the difficulties and inherent risks associated with the operation of equipment from within the water column, vehicle speeds and overall progress would be slowed significantly, and the cycle time required for the removal of individual truck loads of material would be increased. For example, the use of temporary roads would limit the number of transport vehicles within the channel to just one truck at a time, with additional vehicles staged and waiting for passage through the channel to be clear. Further, without the construction of additional access roads and/or turnarounds, each truck would have to travel in reverse for one leg of the round trip. Combined, these limiting factors would increase the handling/transport time associated with each truck load, thereby reducing the overall number of loads of excavated/backfill materials (per day) relative to mechanical removal performed from a barge on the water surface.

When all of the factors are evaluated, it is estimated that the overall average production rate of mechanical dredging in the wet from the channel in Reach 5A (including the time necessary for construction and restoration of additional supporting temporary roads) would be approximately 30-35% slower than the estimated production rate of mechanical dredging in the wet from barges (as used in the CMS Report).

Further, it is anticipated that silt curtains across the channel and/or around the immediate work area would be used to mitigate, to some degree, the turbidity and transport of suspended materials during mechanical removal. The effectiveness and stability of silt curtains are significantly diminished in higher water velocities, and thus silt curtains are not recommended for use in water velocities greater than 1.5 feet per second (fps) (Francingues and Palermo, 2005). The attached Figure C-1 was developed to evaluate expected river velocities in Reaches 5A and 5B in the period between March and

November (when flows would be expected to be amenable to removal in the wet). That figure illustrates for the number of days in that nine-month period when channel velocities are estimated to be greater than approximately 1.5 fps in Reaches 5A and 5B. The number of days with anticipated flows greater than 1.5 fps, combined with the necessary work stop-and-restart activities associated with downtime, indicates that 30 days per year and 15 days per year of available work time in Reaches 5A, and 5B, respectively, would likely be lost due to increased water velocities.

Considering both the reduced efficiency in performing the mechanical dredging from within the channel and the likely increased downtime due to high water velocities in Reach 5A, an average production rate of approximately 165 cy/d for mechanical removal in the wet for Reach 5A has been estimated. This represents an approximate 40% overall reduction compared to the production rate used for mechanical dredging in the downstream reaches. A similar reduction in the mechanical backfill placement rate would be anticipated – i.e., from 220 cy/day (i.e., the mechanical backfill placement rate used in the CMS Report) to 135 cy/day.

Similarly, considering the likely increased downtime due to high water velocities in Reach 5B, an average production rate of approximately 255 cy/d for mechanical removal in the wet for Reach 5B has been estimated, and a related reduction in the mechanical backfill placement rate would also be anticipated – i.e., from 220 cy/day to 200 cy/day.

Using the above production rates and assuming the same overlap of backfill and excavation activities that was used in the CMS for mechanical removal in the wet from the river channel, as well as the associated production rates and assumed overlaps in the downstream reaches, the resulting schedule for completion of SED 9 would be 27 years.

PCB Releases During Dredging

As described in the CMS Proposal, the magnitude of contaminants released during dredging (in the wet) is generally related to the type of equipment used, including both dredging and containment equipment. EPA's Contaminated Sediment Remediation Guidance (EPA, 2005, pp. 6-22 - 6-23) reports that: "Although the degree of resuspension will be site-specific, recent analyses of field studies and available predictive models of the mass of sediment resuspended range from generally less than one percent of the mass dredged (Hayes and Wu 2001, Palermo and Averett 2003) to between 0.5 and 9 percent (NRC 2001)." The NRC (2001) document cited by EPA (2005) indicates that values for silts and clays range from 0.5% to 4.5% for hydraulic dredging and from 2.5% to 9% for mechanical dredging. Given this range of estimates, and professional judgment based on experience at other sites, values closer to the low end of the cited literature range – namely, 1% of the dredged sediment PCB mass for hydraulic dredging and 2% for mechanical

dredging – were selected and approved by EPA for the model simulations of dredging presented in the CMS Report. Review of information from additional site-specific studies (e.g., USGS, 2000) further supports this range of modeled release rates.

However, under SED 9, where mechanical removal in the wet would be performed in Reach 5A, there are several factors that could cause the release rate in that reach to differ from the values used in the original CMS. First, it is anticipated that the higher water velocities in Reach 5A could increase resuspension rates, although this may be offset by the larger-grained sediments typical of that reach, which could reduce resuspension (e.g., NRC 2001). Furthermore, the anticipated approach to performing the work could result in a higher release rate. As discussed above, consistent with EPA's request, SED 9 will assume that sediment excavation in Reach 5A would be performed using conventional equipment operating from within the channel bottom. Because of the potential disturbances of the channel bottom associated with work equipment placed in a flowing river, it is anticipated that the PCB release rate associated with this type of removal would be higher than the previously approved release rate of 2% for mechanical dredging in the wet, which was based on cases studies where work was performed from barge-mounted dredges.

After considering these factors, the release specified in the model for Reach 5A under SED 9 will be specified as a range to capture the uncertainty in this parameter. The upper end of the range will be specified as 9% of the sediment bed PCB mass removed (consistent with the upper bound reported at other sites; NRC 2001), and the lower end will be 5%. The higher value (9%) will be used for the base case model simulation of SED 9, and the lower value (5%) will be used for the lower bound simulation.

As indicated above, water depths in Reach 5B (i.e., typically greater than 5 feet) are sufficient to allow for the use of barge-mounted dredging equipment. Therefore, it will be assumed that mechanical dredging in Reach 5B will have the same release rate of 2% of the dredged bed sediment PCB mass as that previously approved for mechanical dredging in the wet in other downstream reaches, based on use of barge-mounted excavators.

References

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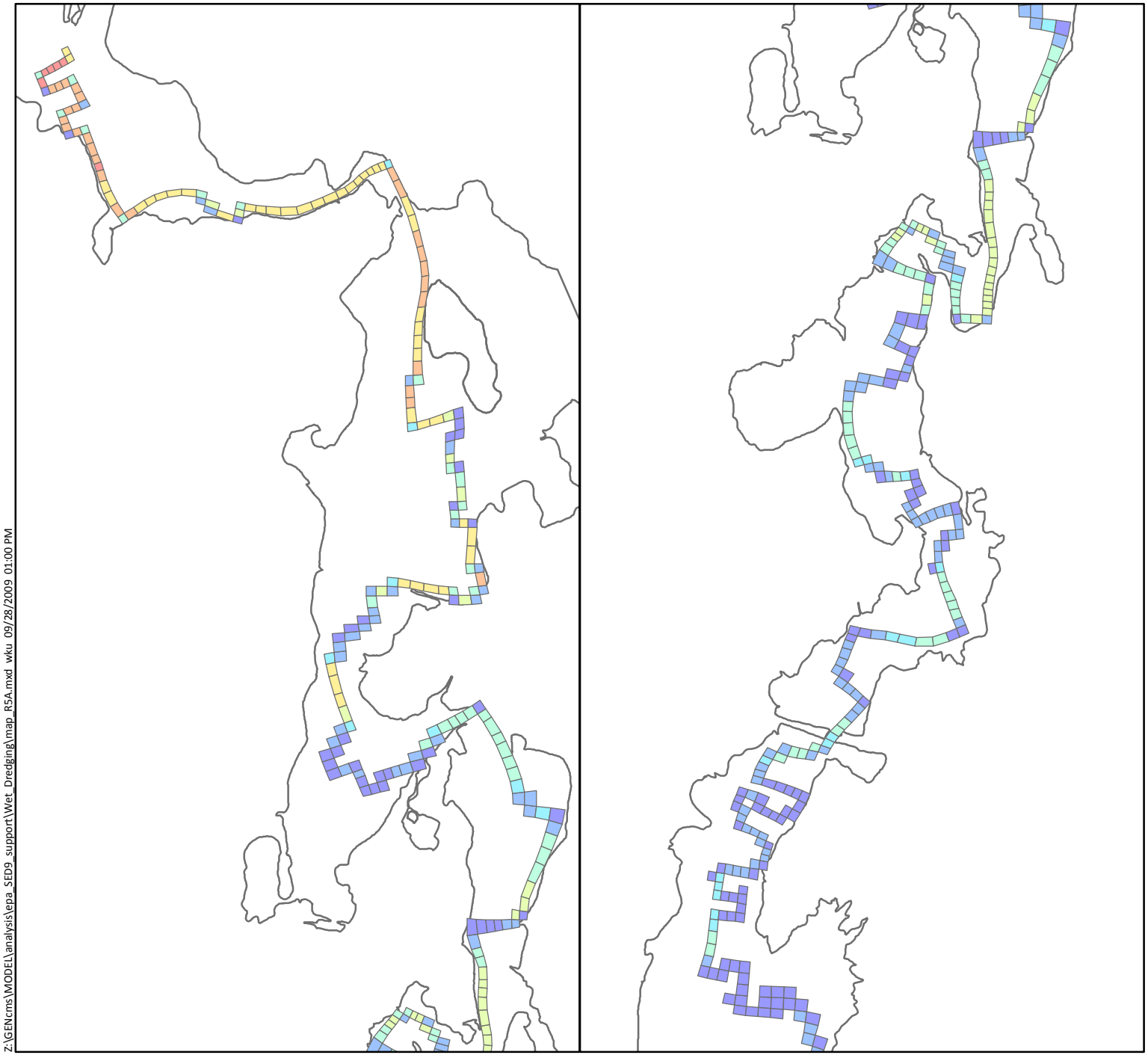

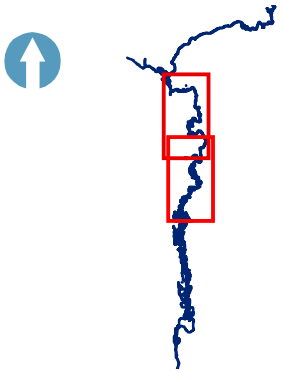

0 1,000 2,000

Feet

LEGEND

1-ppm PCB Isopleth

Average # of Days Exceeding Velocity Criteria

- 1
- 1 - 3
- 3 - 5
- 5 - 10
- 10 - 15
- 15 - 30
- 30 - 60
- >60

Notes:
(a) Wet excavation cannot be conducted when current velocity >= 1.5 ft/s and/or flow >= 2-year flood.
(b) Values were calculated using average of EPA model results from validation period (1979-2004).

Figure C-1.

Average number of days between March and November when wet excavation cannot be conducted.

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