Appendix II-G

Memorandum from Harry Zahakos to Scott Blaha - GE Regarding Adjustments and Pro-rating of Phase 1 Mass-Based PCB Load Criteria. Dated September 19, 2008

Quantitative Environmental Analysis, LLC
∂c/∂t

MEMORANDUM

TO:	Scott Blaha – GE	**DATE:**	September 19, 2008
FROM:	Harry Zahakos	**RE:**	Adjustments and Pro-rating of Phase 1 Mass-Based PCB Load Criteria
CC:	John Connolly – QEA	**JOB#:**	GENfd1:122

Introduction

The Resuspension Performance Standard issued by the U.S. Environmental Protection Agency (EPA) establishes three action levels – Evaluation, Control, and Standard Levels – for near-field and far-field resuspension monitoring and response actions, with specific criteria for each level (EPA 2004). The far-field Evaluation and Control Levels include criteria based on the loads of polychlorinated biphenyls (PCBs) due to resuspension related to dredging. The Control Level criteria are a net PCB load increase for the Phase 1 dredging season of 65 kilograms (kg) of Total PCBs or 22 kg of Tri+ PCBs and a seven-day running average load of 600 grams per day (g/d) of Total PCBs or 200 g/d or Tri+ PCBs. The Evaluation Level includes seven-day running average load criteria at one-half of the Control Level criteria – i.e., 300 g/d of Total PCBs or 100 g/d of Tri+ PCBs.

The Resuspension Standard allows for adjustments of the annual Phase 1 PCB load loss criterion and the daily load loss criteria if the targeted Phase 1 production differs from the assumptions on which those criteria were based (EPA 2004, Volume 2, p. 97). In addition, the Critical Phase 1 Design Elements (CDE), which is an attachment to the Consent Decree, provides that the annual Phase 1 load criterion will be pro-rated to each dredge area in Phase 1 (EPA and GE 2005, Appendix B, Attachment A, Section 2.2). This memorandum describes the PCB load criteria adjustments for Phase 1 of the Remedial Action. It also describes the pro-rated dredge area-specific load values for Phase 1, which will be used in tracking the cumulative PCB mass released against the annual Phase 1 load criteria.

Annual Load Adjustment

The Resuspension Standard notes that the far-field net PCB seasonal load criterion of 65 kg Total PCBs for Phase 1 was based on the assumption that one-tenth of the total PCB inventory assumed to be subject to removal would be targeted for removal in Phase 1, and it indicates that that criterion may be adjusted if the targeted Phase 1 mass removal differs from that assumption (EPA 2004, Volume 2, pp. 95, 97). In fact, as shown in the Phase 1 and Phase 2 Dredge Area Delineation Reports (QEA 2004, QEA 2007), the final estimate of the PCB mass be removed in Phase 1 is 20,300 kg, which represents 18% of the total inventory of 113,100 kg. This can be used to adjust seasonal load loss by applying Equation 4-9 from the Resuspension Standard (EPA 2004, Volume 2, p. 97):

$$S_{tot} = \frac{m}{M} * 650 \qquad (1)$$

where:

S_{tot} = Maximum total allowable far-field PCB mass for Phase 1;

m = Total PCB mass to be dredged in Phase 1 (20,300 kg); and

M = Total PCB mass to be dredged in the remediation (113,100 kg).

Accordingly, the annual allowable load of Total PCBs for Phase 1 should be adjusted to 117 kg. As with the original Phase 1 annual load criterion, the annual allowable load of Tri+ PCBs would be set to one-third of that value at 39 kg.

Daily Load Adjustment

Given these adjustments to the annual Phase 1 load criteria, the seven-day running average daily load criteria for Phase 1 will correspondingly be adjusted by dividing the annual criteria by an assumed dredging season of 108 days, which is the annual Phase 1 Control Level load criterion in the Resuspension Standard (65 kg) divided by the daily Control Level load criterion in that standard (600 g/day). These adjustments result in seven-day running average load criteria, for the Control Level, of 1,083 g/d of Total PCBs and 361 g/day of Tri+ PCBs. As in the Resuspension Standard, the seven-day running average load criteria for the Evaluation Level will be one-half of the Control Level criteria.

Pro-Rated PCB Load Values

In addition, in accordance with the CDE, the adjusted total seasonal PCB mass criteria for Phase 1 will be pro-rated among the dredge areas in Phase 1, so as to allow the cumulative PCB mass flux to be charted against the annual Control Level criteria for the entire season. Such pro-ration is appropriate because, as shown by the Phase 1 resuspension modeling, PCB resuspension and transport will vary based predominantly on local sediment conditions and PCB mass. Dredging of local areas with high PCB inventory may cause exceedances of the seven-day PCB load criteria even though the total seasonal PCB mass remains well below the annual Control Level criteria.

The pro-ration of the annual Phase 1 load criteria among dredge area has been made at the scale of the Phase 1 Certification Units (CUs), which are shown on Figure 1. The method outlined below relies on estimates of the far-field PCB mass due to resuspension in each of the Phase 1 CUs; these estimates represent the relative potential for dredging in each CU to result in PCB transport to the far-field stations. The resulting pro-rated CU-specific values consist of load criteria that are specific to the sediment areas being dredged while still maintaining the total Control Level load criteria for the entire season. As such, they can be used to track the cumulative PCB mass released against the annual Phase 1 load criteria.

Approach

The Phase 1 model results show that far-field PCB mass is closely correlated to the PCB mass associated with the silt and clay (Class 1) component of the dredged sediments. Based on this observation, a screening-level modeling approach was used to estimate the mass of far-field transportable PCB for each CU. This approach is similar to that used in Attachment G to the Phase 2 Intermediate Design Report (Phase 2 IDR Attachment G; QEA 2008); an effective PCB mass has been estimated based on the PCB concentration of the dredged sediments and the mass of the Class 1 component of the dredged sediments. It is also assumed that this effective PCB mass is directly proportional to the far-field PCB mass. Further discussion of this screening-level modeling approach is given in the Phase 2 IDR Attachment G (QEA 2008).

The effective PCB mass for the Phase 1 dredge areas was calculated in a manner similar to the procedure presented in Attachment F of the Phase 1 Final Design Report (Phase 1 FDR Attachment F; QEA 2006). The sediment properties and PCB concentrations have been defined at the scale of the elements (grid cells) used in the Phase 1 resuspension model (QEA 2005, QEA 2006). For each grid cell, the effective PCB mass (EM_k) has been calculated as follows:

$$EM_k = D_k * F_k^1 * C_k^1 \qquad (2)$$

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where:

k = model cell index;

D_k = dredge sediment mass in model cell k;

F_k^1 = fraction of Class 1 sediment in model cell k; and

C_k^1 = PCB concentration (Total or Tri+) of sediment in cell k on sediment Class 1.

The Total PCB concentration of sediment on sediment Class 1 and the fraction of Class 1 sediment by grid cell are shown in Figure F-3-5 and Figure F-3-2, respectively, of the Phase 1 FDR Attachment F.

The total effective PCB mass for a given CU (EM_i) is calculated simply by adding the individual model cells that comprise a CU.

$$EM_i = \sum_k EM_k \tag{3}$$

where:

i = CU index

Using these total effective masses for each CU, a maximum load of resuspended mass per CU (S_i) can be calculated by pro-ration.

$$S_i = S_{tot} * \frac{EM_i}{\sum_i EM_i} \tag{4}$$

where:

S_{tot} = maximum total allowable far-field PCB mass for Phase 1 (117 kg Total PCB or 39 kg Tri+ PCB)

These CU-specific load values (for Total PCBs and Tri+ PCBs) will allow charting of the total mass transported during the Phase 1 dredging against the seasonal Control Level load criteria.

Daily measurements of the far-field PCB concentration and average flow can be used to compute a daily mass transported. When two or more dredges are operating simultaneously in different

CUs, the far-field mass associated with a particular CU will be estimated by apportioning the total far-field mass among the active CUs being dredged based on the relative predicted total PCB mass releases.

In the event that the adjusted seven-day average daily Control Level load criteria are exceeded, the mass released can be compared to the pro-rated value(s) for the CU(s) being addressed, and the cumulative mass load released from all CUs up to that time can be compared to the cumulative allowable mass load up to that time based on the pro-rated values. In that way, it can be determined whether the exceedance of the daily load criteria would be expected to result in an exceedance of the overall Phase 1 Control Level load criteria.

Results

The estimated Total PCB and Tri+ PCB mass per CU are shown in Table 1. Also shown are the pro-rated intra-seasonal Control Level load values (for Total PCBs and Tri+ PCBs) for each CU. As expected, these values are widely variable, ranging from 0.3 kg for CU 1, which represents the dredging of NTIP01 with the least effective PCB mass, to 20.5 kg of Total PCBs for CU 18, which is represents dredging of the southern portion of EGIA01B and contains the highest effective PCB inventory. As shown in Table 1, these CU-specific load limits cumulatively add up to the adjusted total allowable Control Level load for Phase 1 (assuming that all CUs are completed) of 117 kg of Total PCBs and 39 kg of Tri+ PCBs. The effect of implementing resuspension control devices was not considered in this analysis.

Table 1. CU-specific load values based on pro-ration of annual Phase 1 Control Level load criteria.

CU	Volume Dredged (yd^3)	Effective PCB Mass (kg)	Total PCB CU-Specific Load Limits (kg)	Tri+ PCB CU-Specific Load Limits (kg)
CU 1	12,700	24	0.3	0.3
CU 2	14,900	1299	15.1	5.2
CU 3	27,500	1092	12.7	4.2
CU 4	19,600	1471	17.1	5.8
CU 5	9,400	110	1.3	0.5
CU 6	8,300	31	0.4	0.3
CU 7	15,400	283	3.3	1.3
CU 8	14,700	321	3.7	1.2
CU 9	15,900	127	1.5	0.6
CU 10	11,000	65	0.8	0.5
CU 11	11,400	242	2.8	0.9
CU 12	14,000	210	2.4	1.1
CU 13	11,900	158	1.8	0.7
CU 14	16,300	546	6.4	2.4
CU 15	20,200	572	6.7	2.4
CU 16	12,200	169	2.0	0.9
CU 17	11,800	1571	18.3	5.3
CU 18	18,000	1764	20.5	5.4
Totals	**265,200**	**11,760**	**117**	**39**

References

Environmental Protection Agency (EPA), 2004. *Engineering Performance Standards Hudson River PCBs Superfund Site, Volume 2: Technical Basis of the Performance Standard for Dredging Resuspension.* Prepared by Malcolm Pirnie, Inc. and TAMS Consultants, Inc. for U.S. Army Corps of Engineers, Kansas City District on behalf of U.S. Environmental Protection Agency, Region 2. April 2004.

EPA and General Electric Company (GE), 2005. Consent Decree in *United States v. General Electric Company*, No. 1:05-CV-1270, lodged in United States District Court for the Northern District of New York on October 6, 2005; entered by Court on November 2, 2006. Appendix B, *Statement of Work (SOW) for Remedial Action and Operation, Maintenance and Monitoring*, Attachment A, *Critical Phase 1 Design Elements*

Quantitative Environmental Analysis, LLC (QEA), 2008. *Phase 2 Intermediate Design Report, Attachment G - Dredge Resuspension Modeling.* Prepared for General Electric Company, Albany, NY. May 2008.

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QEA, 2006. *Phase 1 Final Design Report, Attachment F - Dredge Resuspension Modeling.* Prepared for General Electric Company, Albany, NY. March 2006.

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QEA, 2004. *Phase 1 Dredge Area Delineation Report.* Prepared for General Electric Company, Albany, NY. January 2004.

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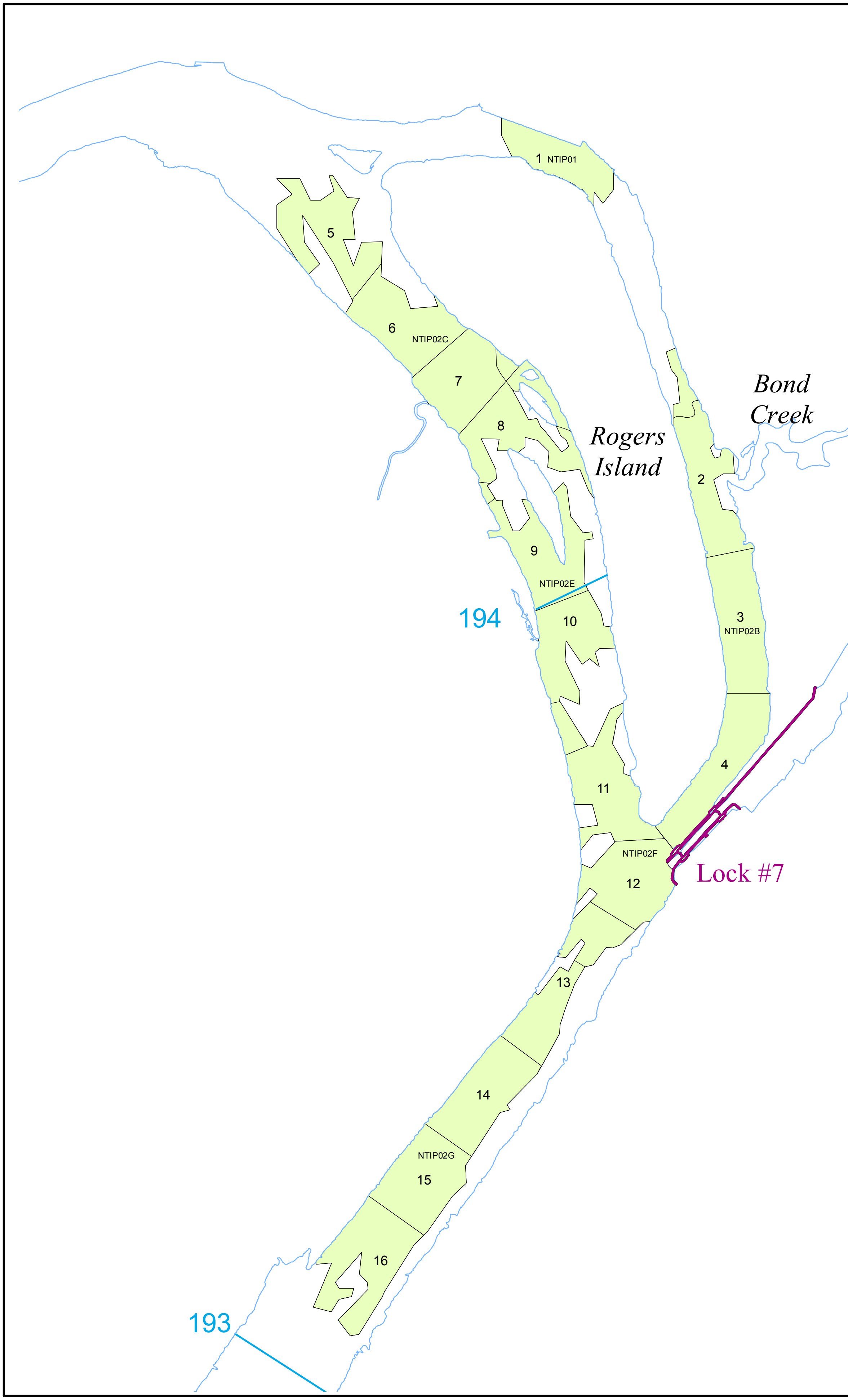
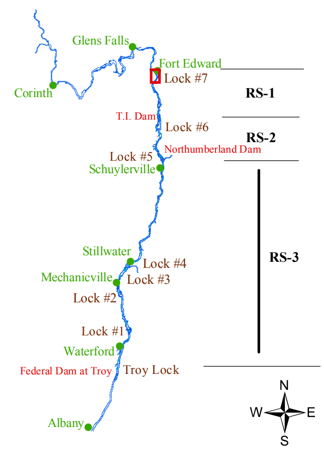


LOCATOR MAP OF THE UPPER HUDSON RIVER



GRAPHIC SCALE

0 250 500 1,000
Feet

LEGEND

- CU Boundaries
- Phase 1 Dredge Areas
- Hudson River Shoreline
- 194 River Mile
- Lock

General Electric Company
Hudson River Project

Figure 1A.
Phase 1
Certification Unit
Boundaries

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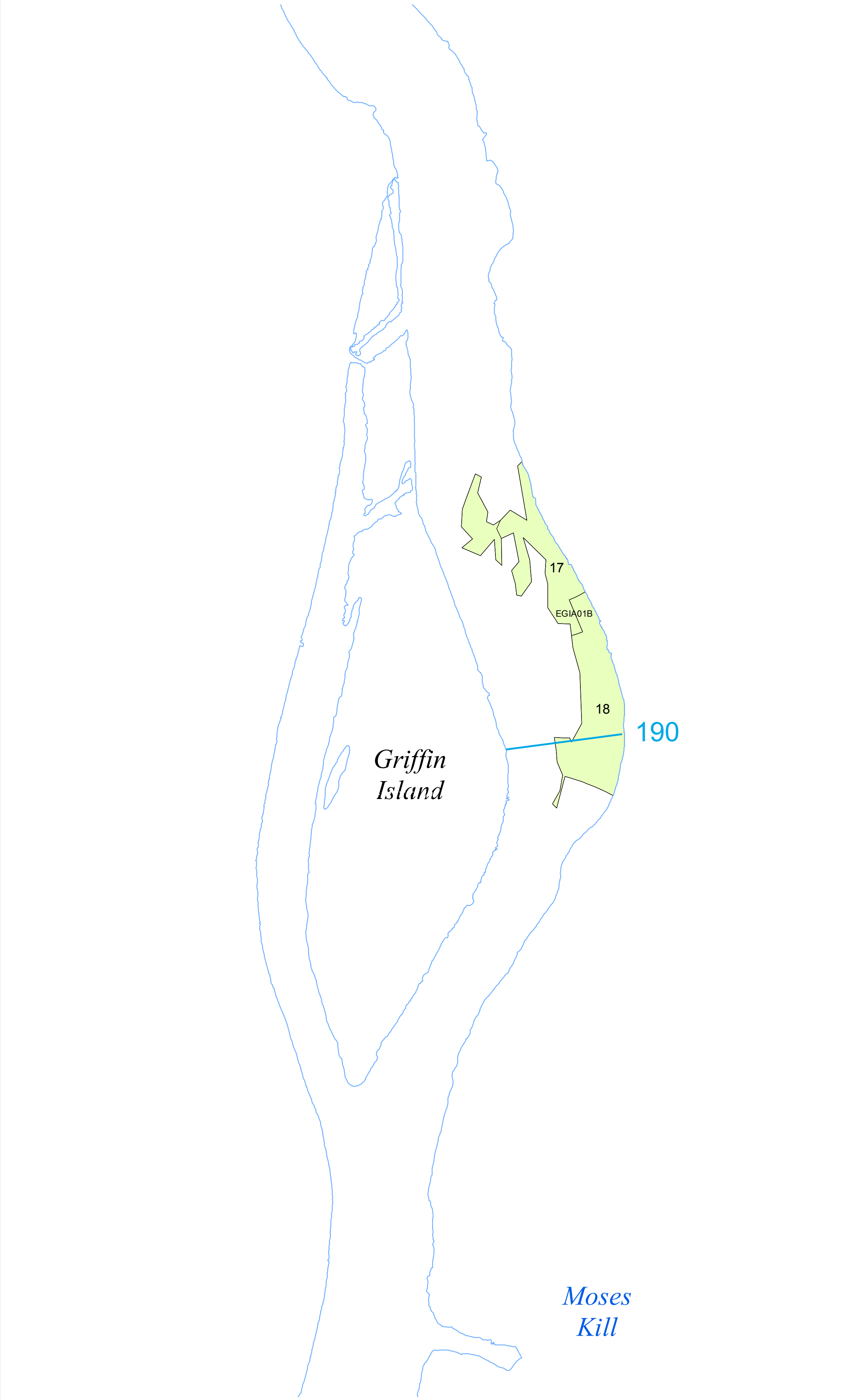

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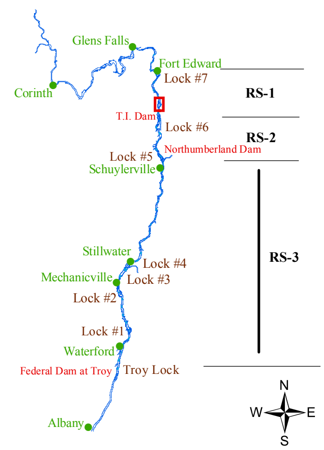

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- CU Boundaries
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Figure 1B.
Phase 1
Certification Unit
Boundaries

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