APPENDIX B

DREDGE PRODUCTIVITY CALCULATIONS

Appendix B
Dredging Productivity Calculations

1. 0 Introduction

This calculation presents the dredging productivity of 5000 gpm slurry at 10% solids content by weight. Calculations under other slurry flow rate and solids content use the same set of equations and procedures and the results are summarized in **Section 2.1.2** .

2. 0 Assumptions

Water density: $\rho_w := 62.4 \frac{lb}{ft^3}$

Maximum flow rate: $q := 5000gpm$

Slurry solids content by weight: $P_s := 10\%$

Average specific gravity, based on Appendix A:

Remediation Area A: $Gs_A := 2.68$

Remediation Area B: $Gs_B := 2.80$

Remediation Area C: $Gs_C := 2.80$

Remediation Area D: $Gs_D := 2.54$

Remediation Area E: $Gs_E := 2.63$

In-situ average water content, based on Appendix A:

Remediation Area A: $WC_A := 80.7\%$

Remediation Area B: $WC_B := 68.4\%$

Remediation Area C: $WC_C := 68.4\%$

Remediation Area D: $WC_D := 148.5\%$

Remediation Area E: $WC_E := 61.3\%$

Note: Specific gravity and water content of Remediation Area B are assumed to be the same as Remediation Area C.

Dredge volume (base plus contingency volume):

$cy := 27ft^3$

Remediation Area A: $V_A := 171000cy$

Remediation Area B: $V_B := 25000cy$

Remediation Area C: $V_C := 49000cy$

Remediation Area D: $V_D := 1204000cy$

Remediation Area E: $V_E := 723000cy$

Total volume: $V_T := V_A + V_B + V_C + V_D + V_E$ $V_T = 2.172 \times 10^6 cy$

3.0 Slurry Water Content

$$WC_{slurry} := \frac{1 - P_s}{P_s} \qquad WC_{slurry} = 900\%$$

4.0 In-situ Dry Density

Remediation Area A: $\rho_{d\_A} := \frac{\rho_w}{\frac{1}{Gs_A} + WC_A}$ $\rho_{d\_A} = 52.9 \frac{lb}{ft^3}$

Remediation Area B: $\rho_{d\_B} := \frac{\rho_w}{\frac{1}{Gs_B} + WC_B}$ $\rho_{d\_B} = 59.9 \frac{lb}{ft^3}$

Remediation Area C: $\rho_{d\_C} := \frac{\rho_w}{\frac{1}{Gs_C} + WC_C}$ $\rho_{d\_C} = 59.9 \frac{lb}{ft^3}$

Remediation Area D: $\rho_{d\_D} := \frac{\rho_w}{\frac{1}{Gs_D} + WC_D}$ $\rho_{d\_D} = 33.2 \frac{lb}{ft^3}$

Remediation Area E: $\rho_{d\_E} := \frac{\rho_w}{\frac{1}{Gs_E} + WC_E}$ $\rho_{d\_E} = 62.8 \frac{lb}{ft^3}$

5.0 Weight of Total Dry Solids

Remediation Area A: $W_{s\_A} := V_A \cdot \rho_{d\_A}$ $W_{s\_A} = 1.221 \times 10^5 ton$

Remediation Area B: $W_{s\_B} := V_B \cdot \rho_{d\_B}$ $W_{s\_B} = 2.023 \times 10^4 ton$

Remediation Area C: $W_{s\_C} := V_C \cdot \rho_{d\_C}$ $W_{s\_C} = 3.965 \times 10^4 ton$

Remediation Area D: $W_{s\_D} := V_D \cdot \rho_{d\_D}$ $W_{s\_D} = 5.399 \times 10^5 ton$

Remediation Area E: $W_{s\_E} := V_E \cdot \rho_{d\_E}$ $W_{s\_E} = 6.132 \times 10^5 ton$

6.0 Slurry Specific Gravity

Remediation Area A: $Gsm\_A := \frac{1 + WC_{slurry}}{\frac{1}{Gs_A} + WC_{slurry}}$ $Gsm\_A = 1.07$

Remediation Area B: $Gsm\_B := \frac{1 + WC_{slurry}}{\frac{1}{Gs_B} + WC_{slurry}}$ $Gsm\_B = 1.07$

Remediation Area C: $Gsm\_C := \frac{1 + WC_{slurry}}{\frac{1}{Gs_C} + WC_{slurry}}$ $Gsm\_C = 1.07$

Remediation Area D: $Gsm\_D := \frac{1 + WC_{slurry}}{\frac{1}{Gs_D} + WC_{slurry}}$ $Gsm\_D = 1.06$

Remediation Area E: $Gsm\_E := \frac{1 + WC_{slurry}}{\frac{1}{Gs_E} + WC_{slurry}}$ $Gsm\_E = 1.07$

7.0 Dry Solids Flow Rate

Remediation Area A: $Solids_A := q \cdot Gsm\_A \cdot \rho_w \cdot P_s$ $Solids_A = 2.67 \times 10^5 \frac{lb}{hr}$

Remediation Area B: $Solids_B := q \cdot Gsm\_B \cdot \rho_w \cdot P_s$ $Solids_B = 2.674 \times 10^5 \frac{lb}{hr}$

Remediation Area C: $Solids_C := q \cdot Gsm\_C \cdot \rho_w \cdot P_s$ $Solids_C = 2.674 \times 10^5 \frac{lb}{hr}$

Remediation Area D: $Solids_D := q \cdot Gsm\_D \cdot \rho_w \cdot P_s$ $Solids_D = 2.664 \times 10^5 \frac{lb}{hr}$

Remediation Area E: $Solids_E := q \cdot Gsm\_E \cdot \rho_w \cdot P_s$ $Solids_E = 2.668 \times 10^5 \frac{lb}{hr}$

8.0 Production Rate

Remediation Area A: $PR_A := \frac{Solids_A}{\rho_{d\_A}}$ $PR_A = 187 \frac{cy}{hr}$

Remediation Area B: $PR_B := \frac{Solids_B}{\rho_{d\_B}}$ $PR_B = 165 \frac{cy}{hr}$

Remediation Area C: $PR_C := \frac{Solids_C}{\rho_{d\_C}}$ $PR_C = 165 \frac{cy}{hr}$

Remediation Area D: $PR_D := \frac{Solids_D}{\rho_{d\_D}}$ $PR_D = 297 \frac{cy}{hr}$

Remediation Area E: $PR_E := \frac{Solids_E}{\rho_{d\_E}}$ $PR_E = 157 \frac{cy}{hr}$

9.0 Dredging Time Required

9.1 Dredge days for each Remediation Area

Assuming 17 working hours per day, which is approximately 70%.

Remediation Area A: $DAY_A := \frac{V_A}{PR_A \cdot 70\%}$ $DAY_A = 54\,day$

Remediation Area B: $DAY_B := \frac{V_B}{PR_B \cdot 70\%}$ $DAY_B = 9\,day$

Remediation Area C: $DAY_C := \frac{V_C}{PR_C \cdot 70\%}$ $DAY_C = 18\,day$

Remediation Area D: $DAY_D := \frac{V_D}{PR_D \cdot 70\%}$ $DAY_D = 241\,day$

Remediation Area E: $DAY_E := \frac{V_E}{PR_E \cdot 70\%}$ $DAY_E = 274\,day$

9.2 Total dredge days

$week := 7day$

$DAY_T := DAY_A + DAY_B + DAY_C + DAY_D + DAY_E$ $DAY_T = 596\,day$ $DAY_T = 85.1\,week$

9.3 Total working days in one season

Assume each dredge season is 30 weeks (Apr. 15 to Nov. 15), total 210 days.
Assume 32 Metro shutdown days

$Season := 210day - 32day$ $Season = 178\,day$

9.4 Total seasons required

$Season_T := \frac{DAY_T}{Season}$ $Season_T = 3.35$