Portland Harbor Preferred Alternative

Presentation to the
CSTAG/NRRB
November 18, 2015

Kristine Koch, U.S. EPA Region 10

Refinement of PRGs

- Have 1 PRG for each COC in each medium
  - Sediment/Soil
  - Surface water
  - Pore water
  - Tissue
- Use lowest PRG
- *See draft Table*

Alternative E

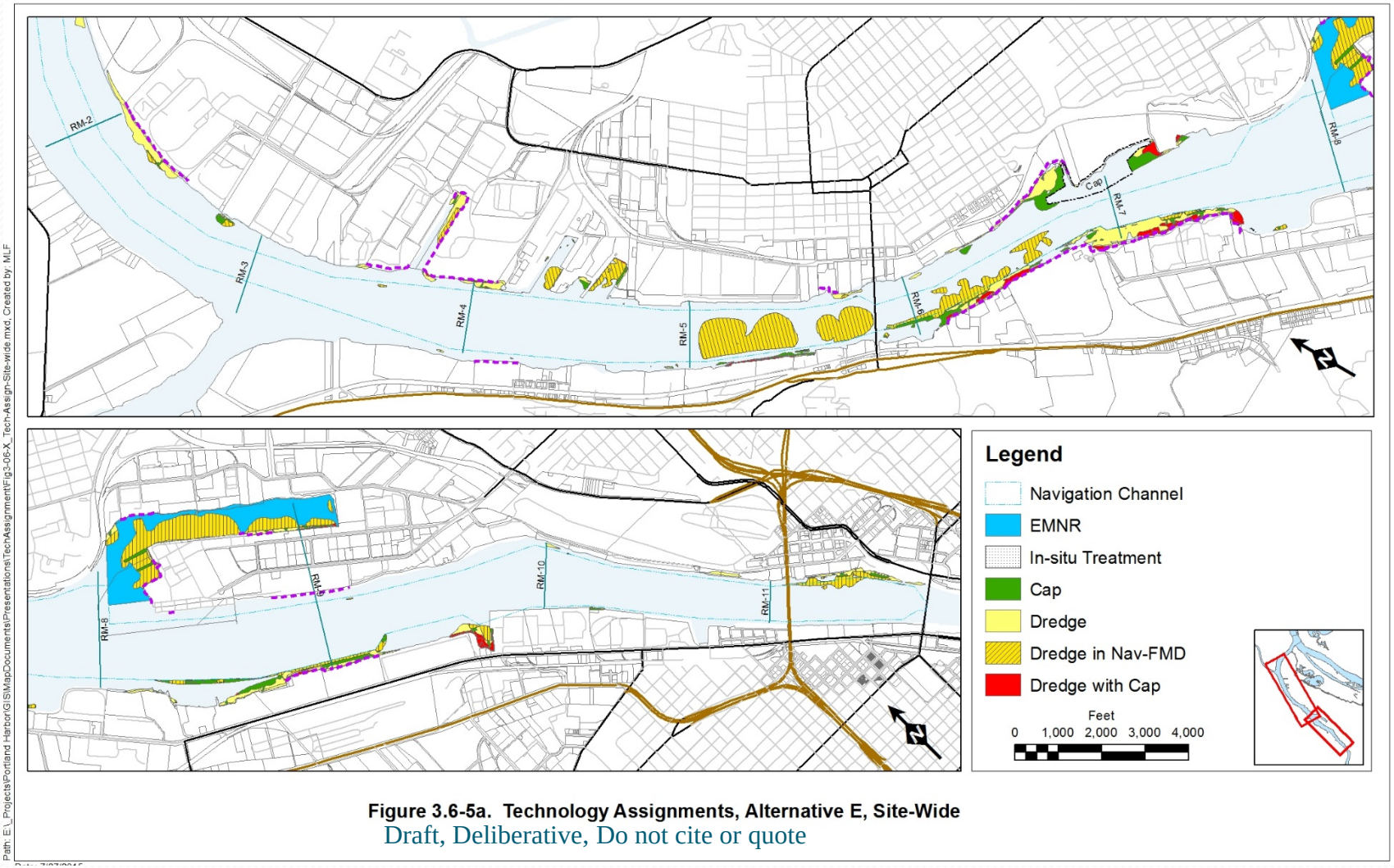

Figure 3.6-5a. Technology Assignments, Alternative E, Site-Wide

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Alternative E Summary

- Dredge 204 acres
  - 2,147,429 cy
  - 455,000 cy ex-situ treatment
- Cap 83 acres
- EMNR 60 acres
- MNR 1,838 acres
- 16,596 lineal ft riverbank
  - Excavate 91,000 cy
  - Cap 20 acres
- 7 years
- $1.5 billion

PTW Footprint

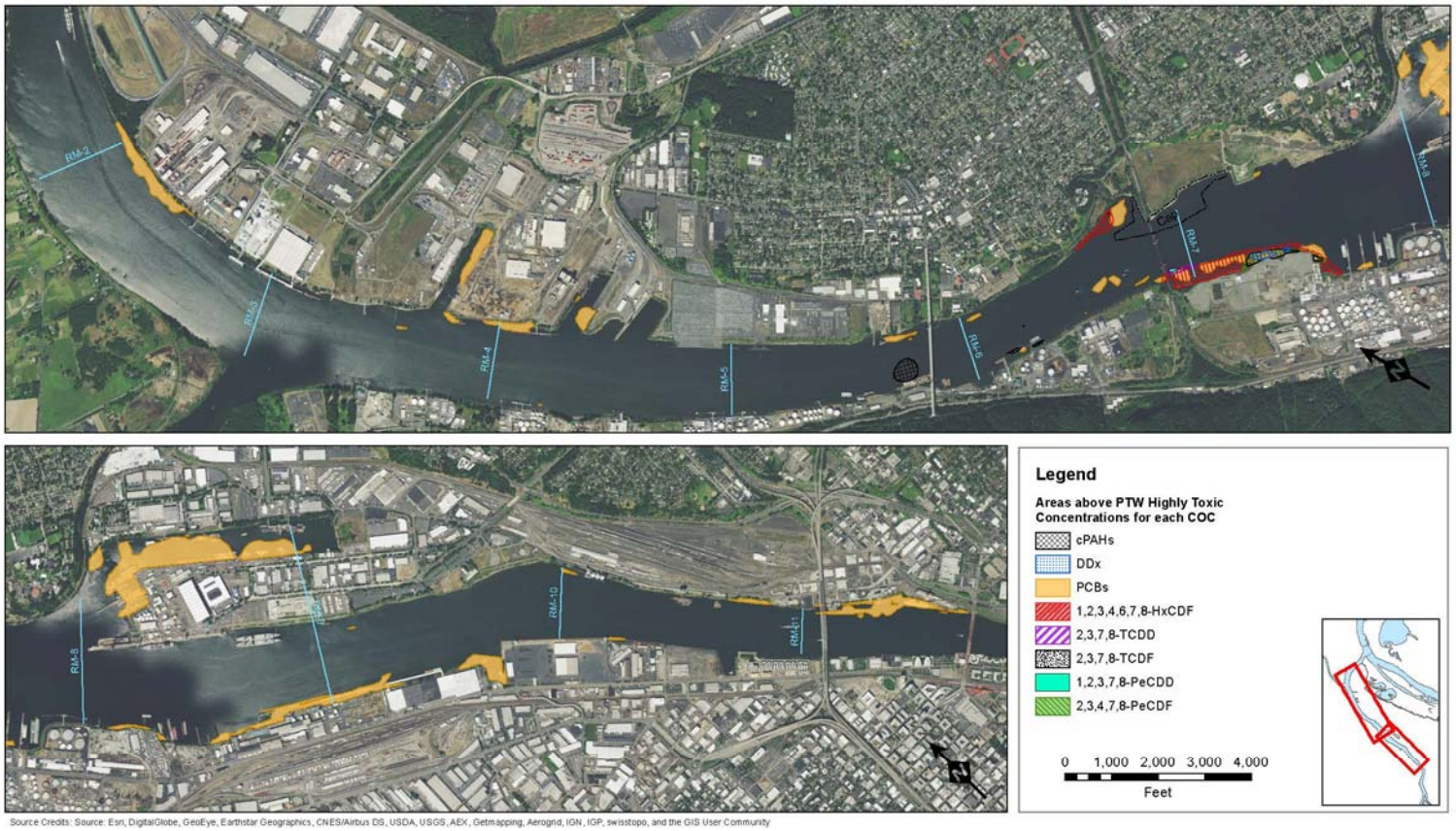


Figure 3.2-3. Highly Toxic PTW Contours (Surface Sediment)

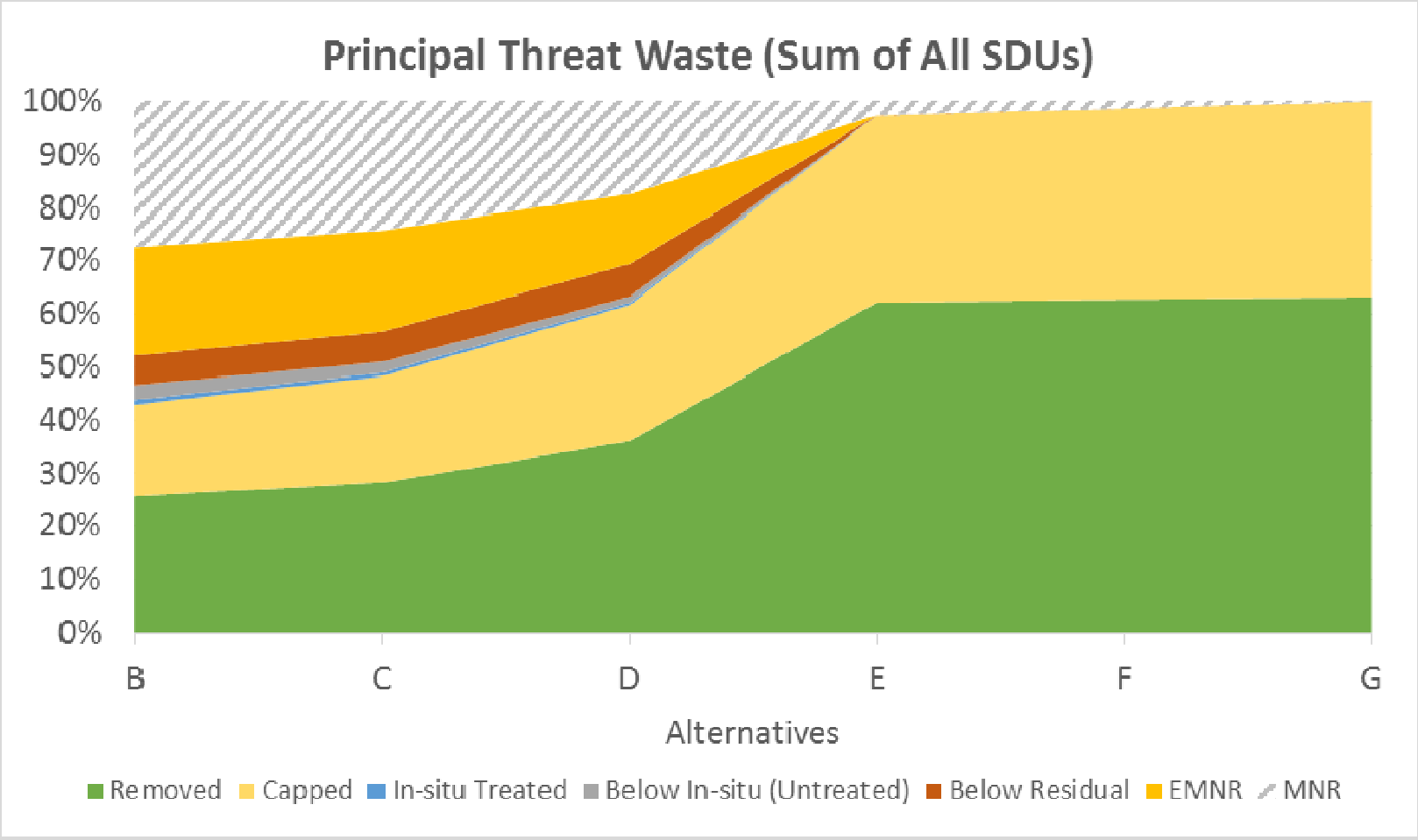
Path: E:_Projects\Portland Harbor\GIS\MapDocuments\FS Figures\Section 3\Fig3-02-03_PTW-Concentrations_102.mxd

Date: 9/3/2015

PTW

- PTW left in place
  - Reactive cap
    - Reliably contained
    - Reduces bioavailability
- PTW removed
  - Not all PTW will be treated ex-situ
  - Follow disposal decision tree logic

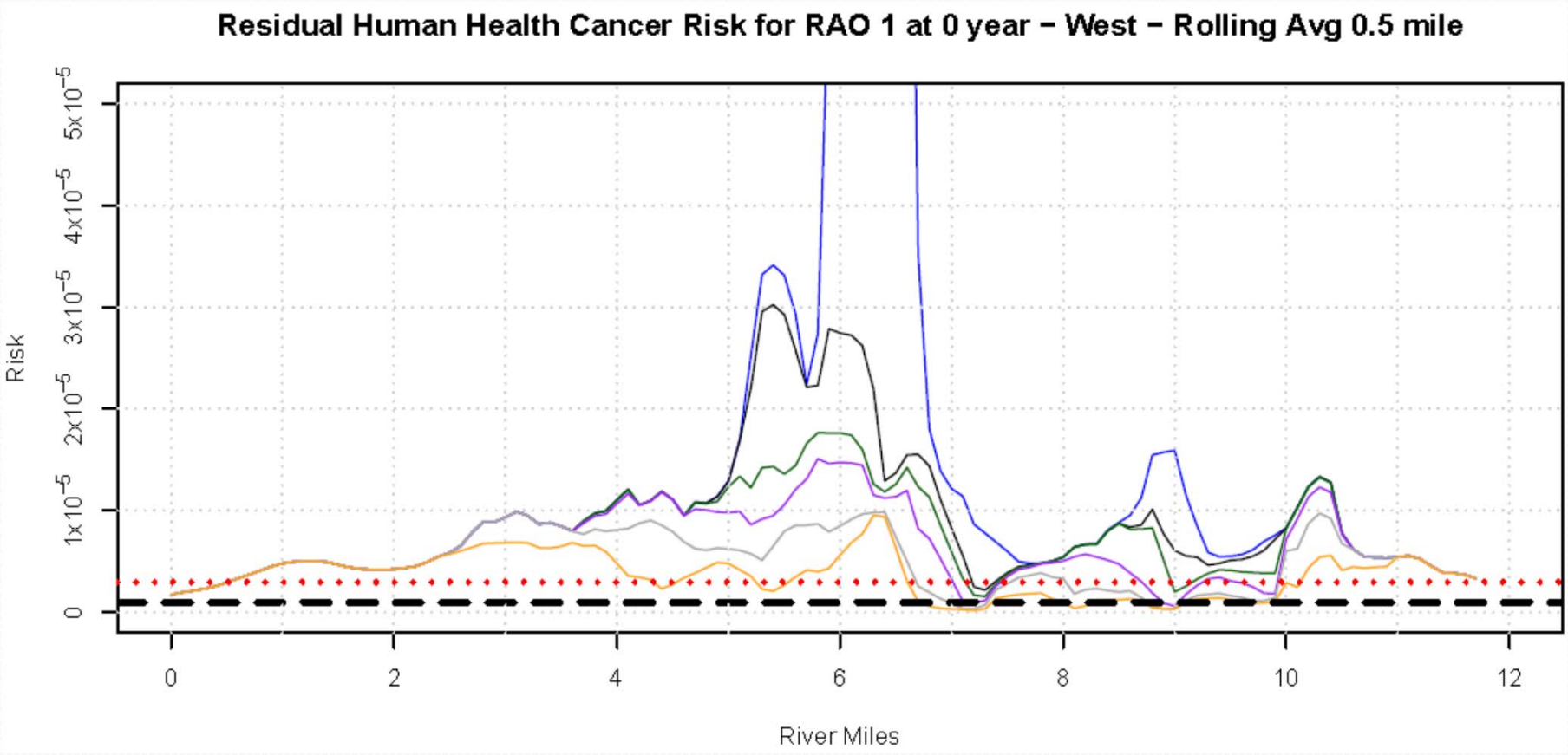
PTW Addressed by Technology



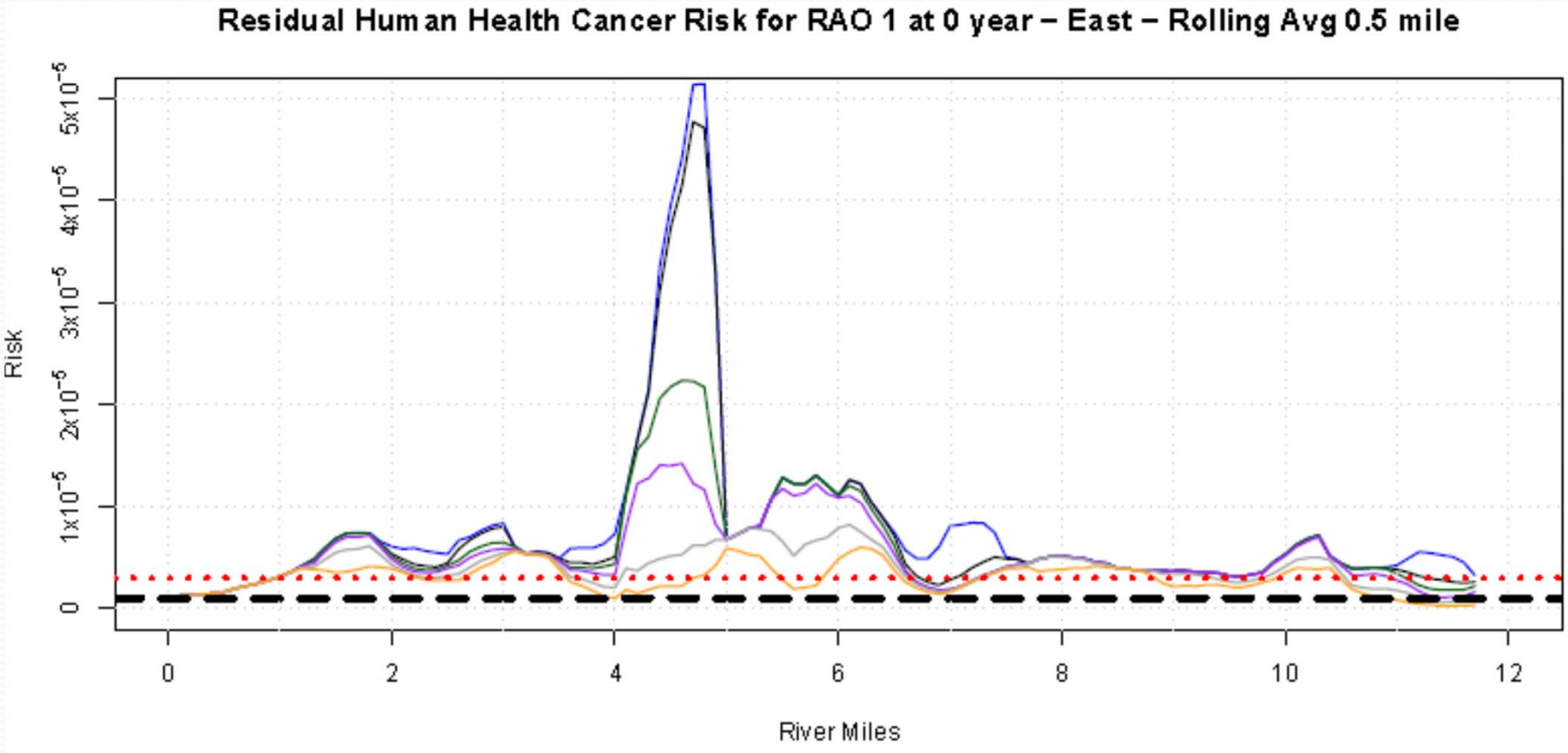
Residual Risk @ t=0 – RAO 1

- 7 of 8 PRGs met throughout site
- cPAHs met in 4 of 13 SDUs
  - <10x PRG in remaining SDUs
- RR/rolling 0.5 RM – less than 2×10^{-5}
- RR/SDU (~1 RM) – less than 1×10^{-5}

RAO 1 – Residual Risk (cancer)



RAO 1 - Residual Risk (cancer)



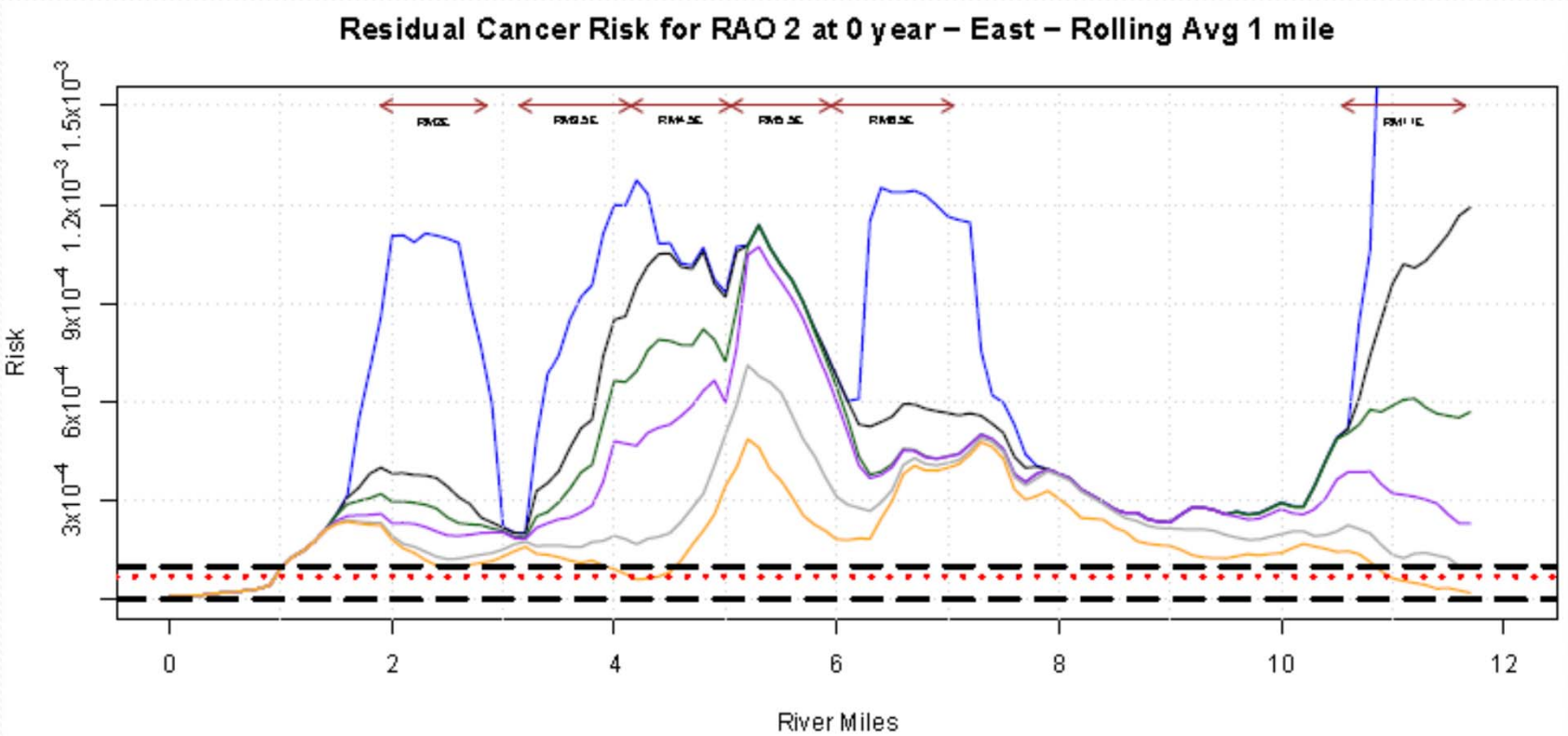
RAO 1 – Residual Risk @ t=0

Cancer	Co.A	Co.B	Co.C	Co.D	Co.E	Co.F	Co.G
NoSDU	5E-06	5E-06	5E-06	5E-06	5E-06	5E-06	4E-06
RM2E	7E-06	6E-06	6E-06	5E-06	5E-06	5E-06	4E-06
RM3.5E	6E-06	5E-06	5E-06	5E-06	4E-06	3E-06	3E-06
RM3.9W	9E-06	9E-06	9E-06	9E-06	9E-06	8E-06	5E-06
RM4.5E	4E-05	3E-05	3E-05	2E-05	1E-05	5E-06	2E-06
RM5W	2E-05	2E-05	2E-05	1E-05	9E-06	6E-06	3E-06
RM5.5E	1E-05	1E-05	1E-05	1E-05	1E-05	7E-06	3E-06
RM6Nav	1E-04	3E-05	2E-05	1E-05	8E-06	3E-06	1E-06
RM6W	2E-04	2E-05	2E-05	1E-05	8E-06	4E-06	2E-06
RM6.5E	8E-06	7E-06	7E-06	6E-06	6E-06	5E-06	4E-06
RM7W	3E-05	7E-06	7E-06	6E-06	4E-06	2E-06	1E-06
SwanIs	1E-05	5E-07	5E-07	5E-07	5E-07	5E-07	4E-07
RM9W	9E-06	7E-06	7E-06	6E-06	3E-06	1E-06	1E-06
RM11E	4E-06	3E-06	3E-06	3E-06	2E-06	1E-06	7E-07

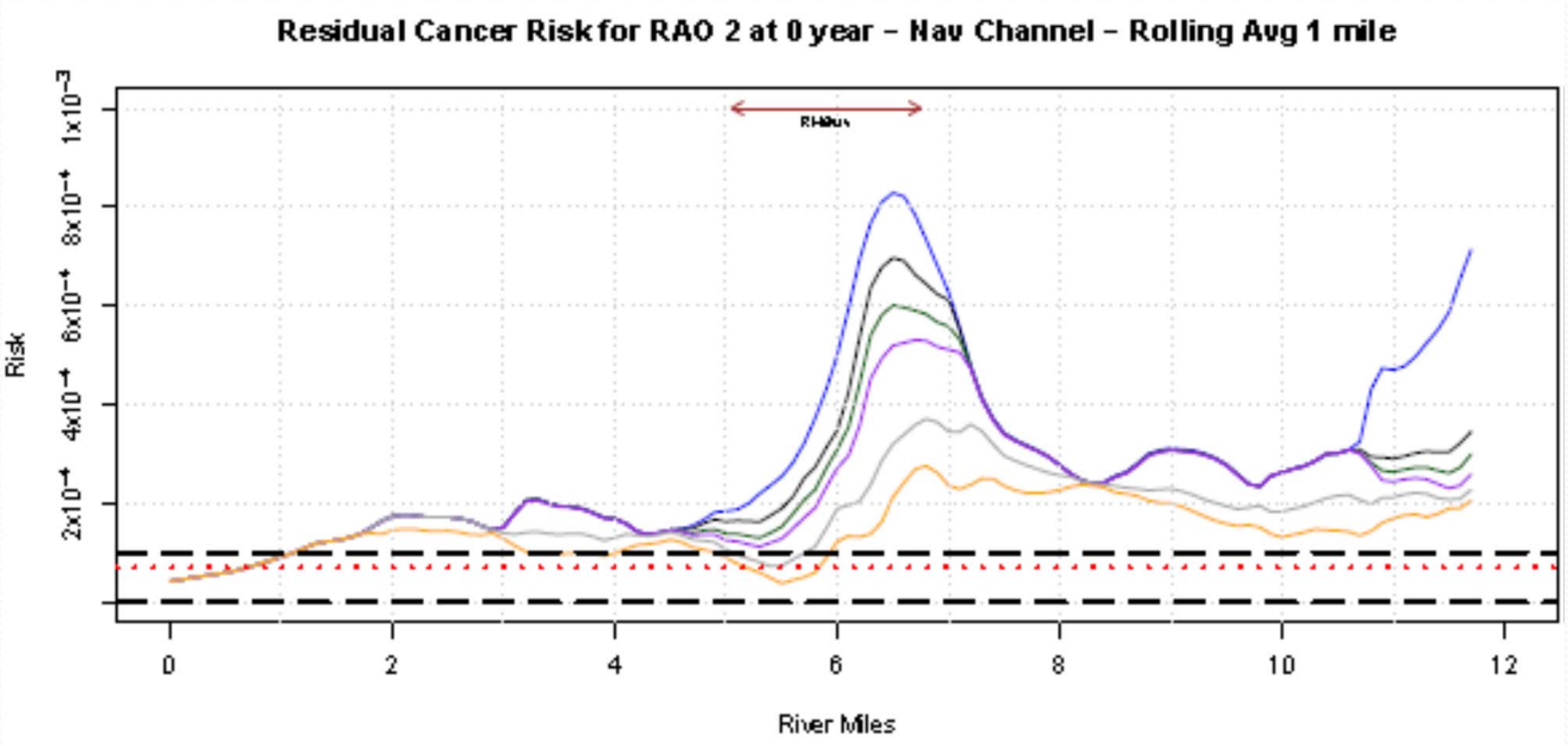
Residual Risk @ t=0 – RAO 2

- 2 of 11 PRGs met throughout site
- 8 of 11 PRGs met or <10x PRG
- HxCDF >10x PRG
- RR/rolling 1 RM – less than 2×10^{-3}
- RR/SDU (~1 RM) – less than 3×10^{-4} & child HI < 14
  - Based on 49 g/day
  - Infant HI < 17,000

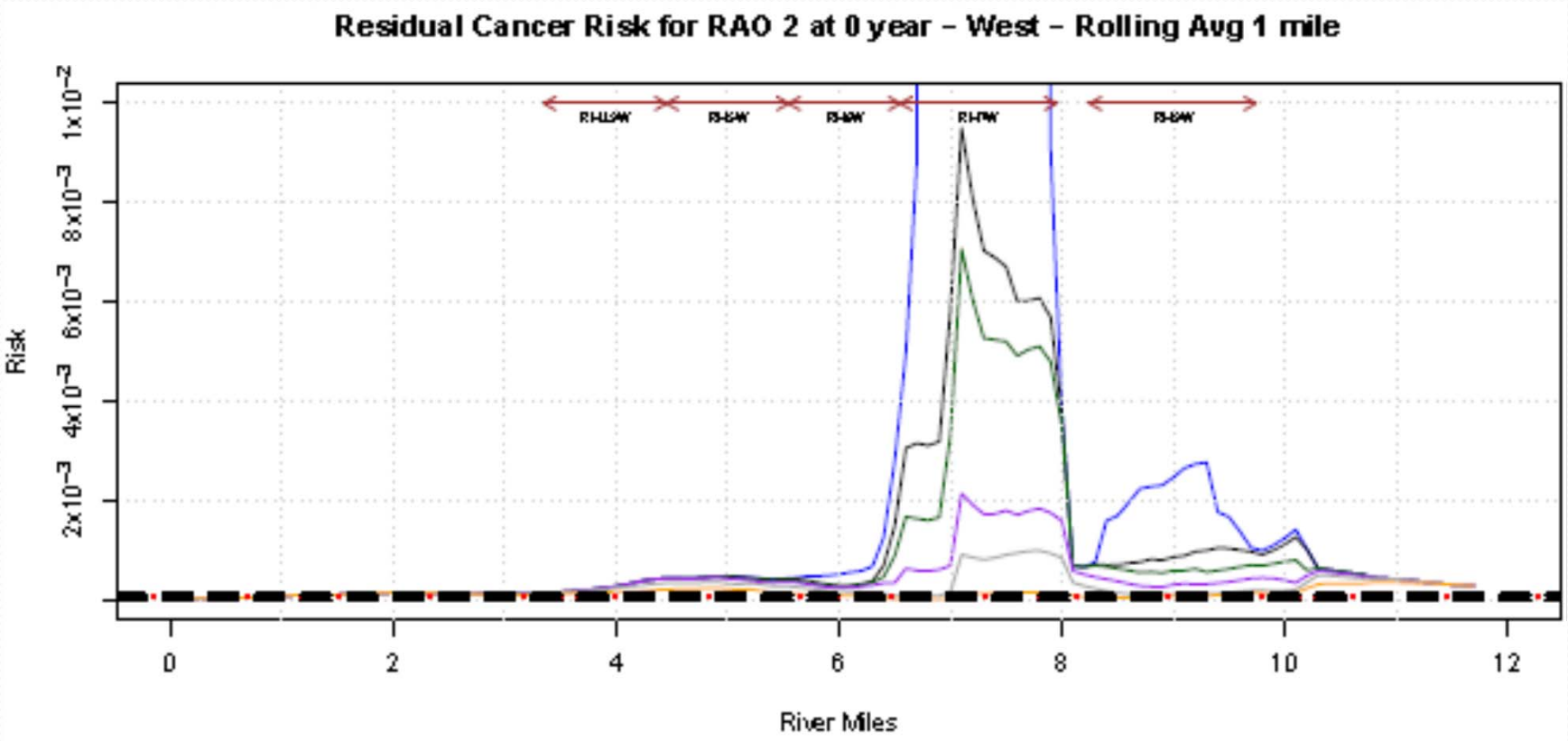
RAO 2 – Residual Risk (cancer)



RAO 2 – Residual Risk (cancer)



RAO 2 – Residual Risk (cancer)



RAO 2 – Residual Risk (cancer) @ t=0

Cancer	Co.A	Co.B	Co.C	Co.D	Co.E	Co.F	Co.G
NoSDU	2.E-04	2.E-04	2.E-04	2.E-04	2.E-04	1.E-04	1.E-04
RM2E	6.E-04	2.E-04	2.E-04	2.E-04	1.E-04	1.E-04	8.E-05
RM3.5E	5.E-04	3.E-04	2.E-04	2.E-04	1.E-04	9.E-05	6.E-05
RM3.9W	1.E-04	1.E-04	1.E-04	1.E-04	1.E-04	9.E-05	7.E-05
RM4.5E	4.E-04	4.E-04	4.E-04	3.E-04	2.E-04	9.E-05	4.E-05
RM5W	2.E-04	2.E-04	2.E-04	1.E-04	1.E-04	1.E-04	7.E-05
RM5.5E	3.E-04	3.E-04	3.E-04	3.E-04	3.E-04	2.E-04	9.E-05
RM6Nav	2.E-04	1.E-04	1.E-04	1.E-04	1.E-04	5.E-05	3.E-05
RM6W	2.E-04	1.E-04	1.E-04	9.E-05	7.E-05	4.E-05	2.E-05
RM6.5E	5.E-04	2.E-04	2.E-04	2.E-04	2.E-04	2.E-04	1.E-04
RM7W	2.E-02	1.E-03	9.E-04	8.E-04	3.E-04	2.E-04	3.E-05
SwanIs	2.E-03	1.E-05	1.E-05	1.E-05	1.E-05	1.E-05	1.E-05
RM9W	1.E-03	5.E-04	4.E-04	3.E-04	2.E-04	6.E-05	4.E-05
RM11E	2.E-03	6.E-04	5.E-04	3.E-04	2.E-04	7.E-05	4.E-05

RAO 2 – Residual Risk (child - noncancer) @ t=0

Noncancer	Co.A	Co.B	Co.C	Co.D	Co.E	Co.F	Co.G
NoSDU	15	14	14	14	14	12	10
RM2E	30	10	9	8	6	5	4
RM3.5E	27	14	12	10	7	4	3
RM3.9W	4	4	4	4	4	4	3
RM4.5E	16	16	15	12	8	4	2
RM5W	6	6	6	5	5	4	2
RM5.5E	13	13	13	13	12	6	3
RM6Nav	6	6	5	4	3	1	1
RM6W	9	4	4	3	3	2	1
RM6.5E	17	7	7	6	6	4	4
RM7W	479	31	28	23	10	5	1
SwanIs	91	1	1	1	1	1	0
RM9W	53	23	20	16	8	3	1
RM11E	78	27	21	16	8	3	1

RAO 2 – Residual Risk (infant – noncancer) @ t=0

Noncancer	Co.A	Co.B	Co.C	Co.D	Co.E	Co.F	Co.G
NoSDU	8,964	8,819	8,803	8,771	8,686	7,251	5,997
RM2E	57,304	19,932	17,520	15,337	11,993	8,718	7,638
RM3.5E	50,384	26,162	22,534	19,499	12,470	6,882	4,581
RM3.9W	7,665	7,665	7,665	7,665	7,591	6,587	4,856
RM4.5E	26,921	26,835	24,657	19,792	14,023	6,355	2,868
RM5W	8,997	8,909	8,742	8,349	8,074	5,626	3,311
RM5.5E	20,840	20,759	20,759	20,759	17,873	7,641	3,453
RM6Nav	10,156	9,029	8,753	7,058	5,560	2,011	907
RM6W	13,584	6,149	5,914	5,293	4,445	2,667	1,162
RM6.5E	27,893	11,467	11,041	10,364	9,929	6,518	5,416
RM7W	69,612	23,514	19,946	16,010	10,579	6,060	1,953
SwanIs	173,677	1,012	1,012	1,012	1,012	949	831
RM9W	100,963	42,500	38,050	29,713	15,443	4,630	2,612
RM11E	148,518	51,122	40,372	29,739	14,318	4,824	1,921

Increase in Fish consumption*

Increase Relative to Alternative A	
SDU	**E**
RM2E	79%
RM3.5E	75%
RM3.9W	1%
RM4.5E	48%
RM5W	10%
RM5.5E	14%
RM6Nav	45%
RM6W	67%
RM6.5E	64%
RM7W	78%
SwanIs	99%
RM9W	85%
RM11E	90%

Note: Areas where fish consumption does not pose an unacceptable risk have low relative increase in fish consumption.
Based only on PCBS.

Fish meals per year*

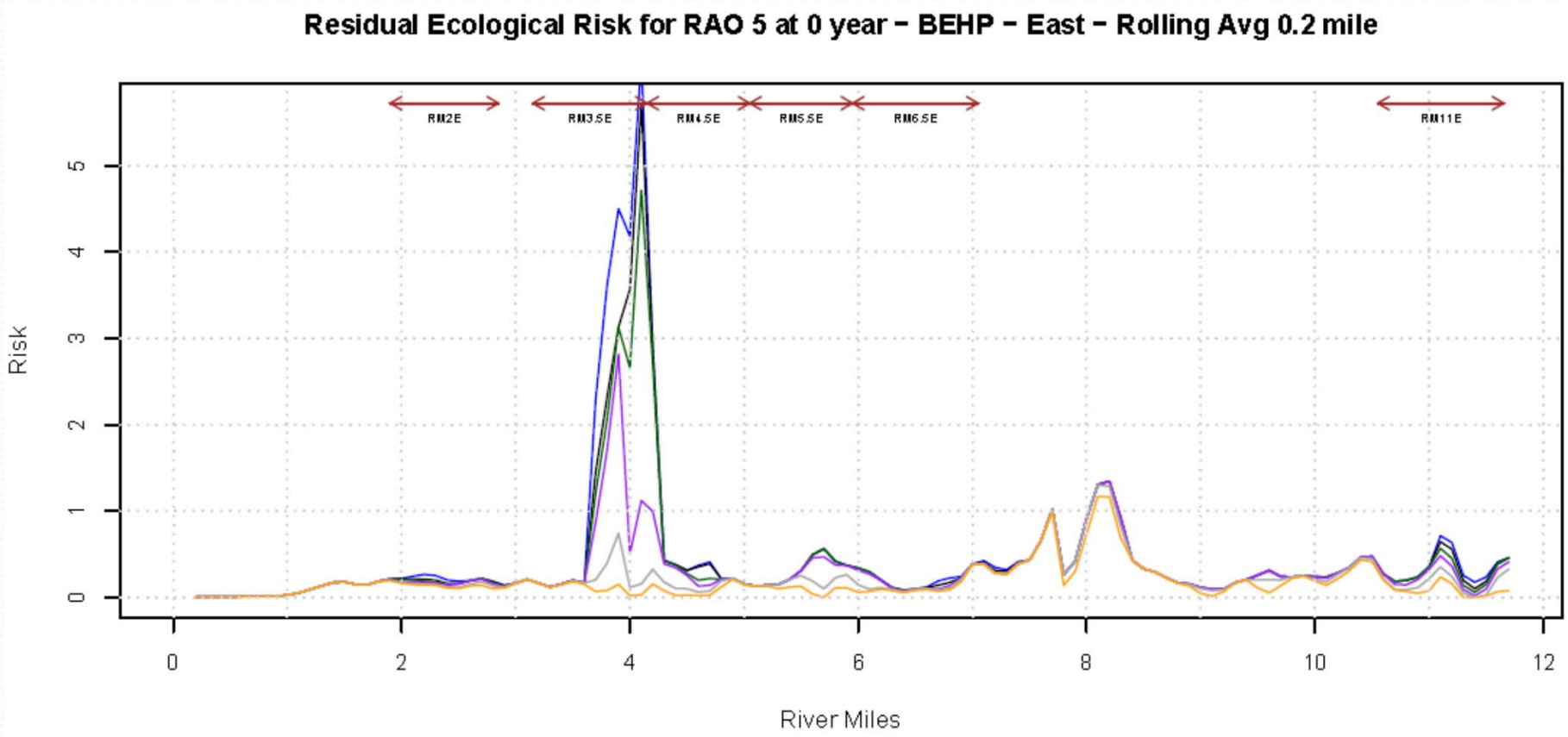
	Current			Alt E		
SDU	Adult	Child	Infant	Adult	Child	Infant
RM2E	0.3	1.1	0.1	1.5	5.5	0.6
RM3.5E	0.4	1.3	0.1	1.4	5.3	0.6
RM3.9W	2.3	8.5	1.0	2.3	8.6	1.0
RM4.5E	0.7	2.4	0.3	1.3	4.7	0.5
RM5W	2.0	7.3	0.8	2.2	8.1	0.9
RM5.5E	0.9	3.2	0.4	1.0	3.7	0.4
RM6Nav	1.8	6.5	0.7	3.2	11.7	1.3
RM6W	1.3	4.8	0.6	4.0	14.6	1.7
RM6.5E	0.6	2.4	0.3	1.8	6.6	0.8
RM7W	0.4	1.4	0.2	1.7	6.3	0.7
SwanIs	0.1	0.4	0.0	16.2	59.7	6.8
RM9W	0.2	0.7	0.1	1.2	4.2	0.5
RM11E	0.1	0.4	0.1	1.2	4.6	0.5

Note: Based only on PCBs.

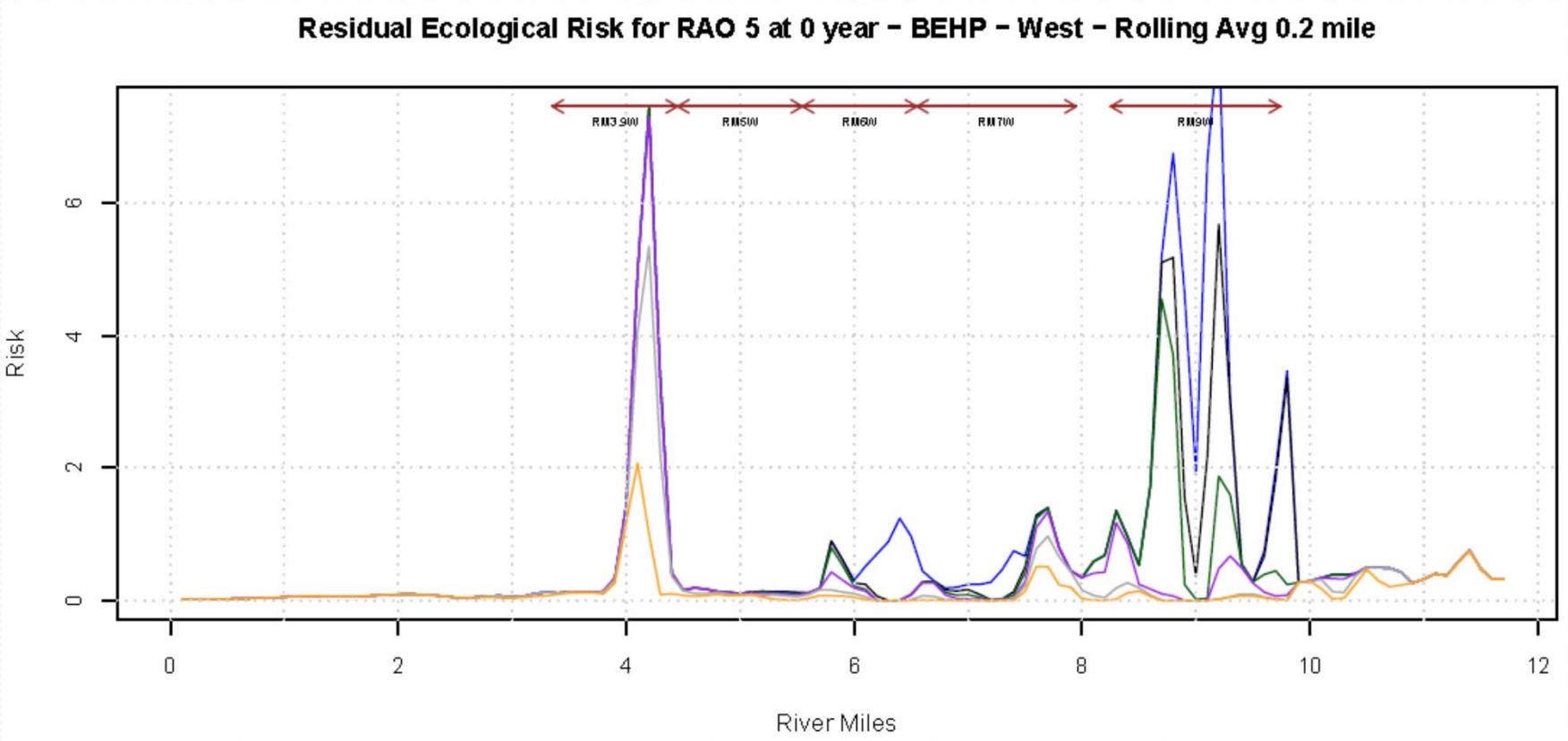
Residual Risk @ t=0 – RAO 5

- 16 of 18 PRGs met throughout site
- 2 PRGs <10x PRG
- RR/rolling 0.2 RM – HQs < 3
- RR/SDU (~1 RM) – HI < 7

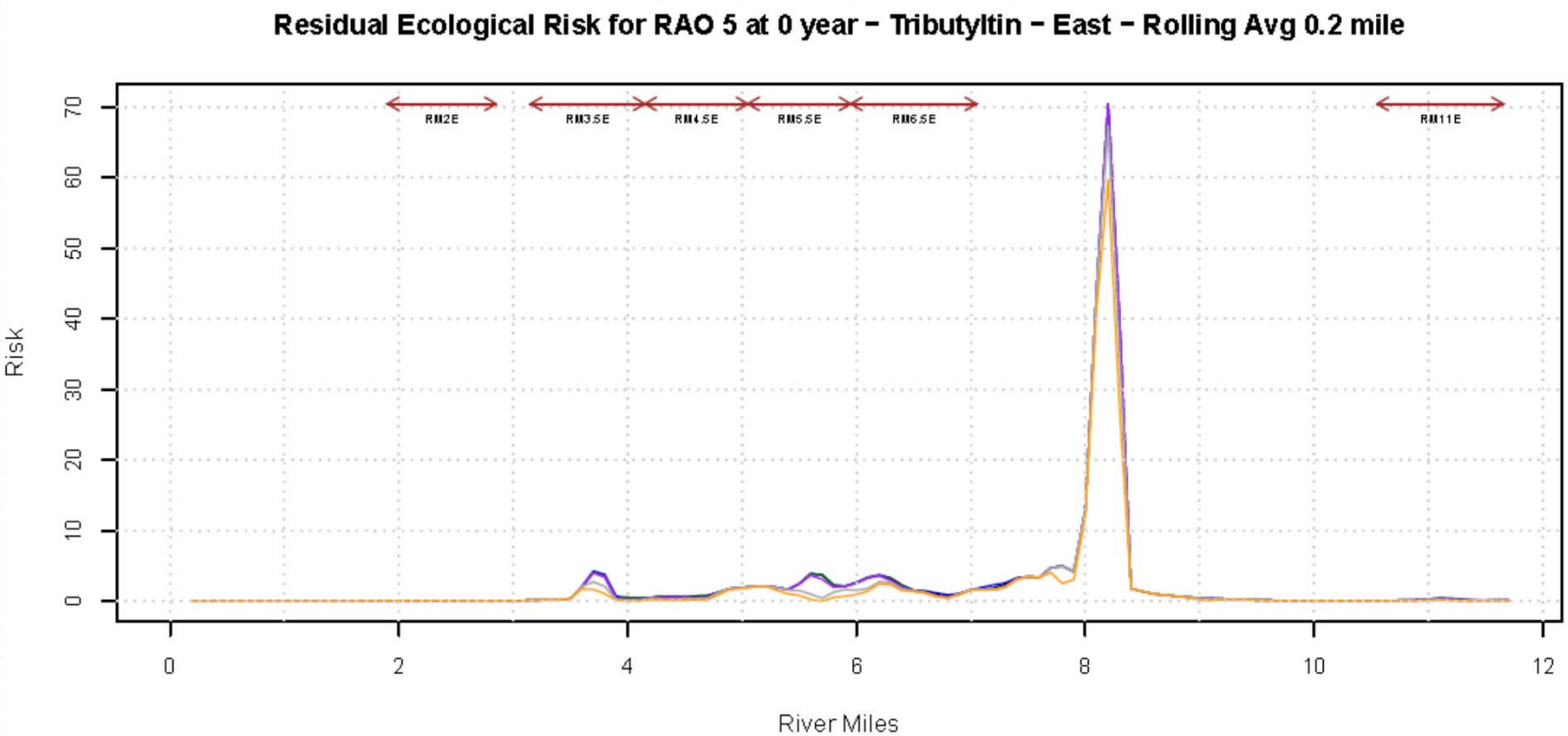
RAO 5 – Residual Risk



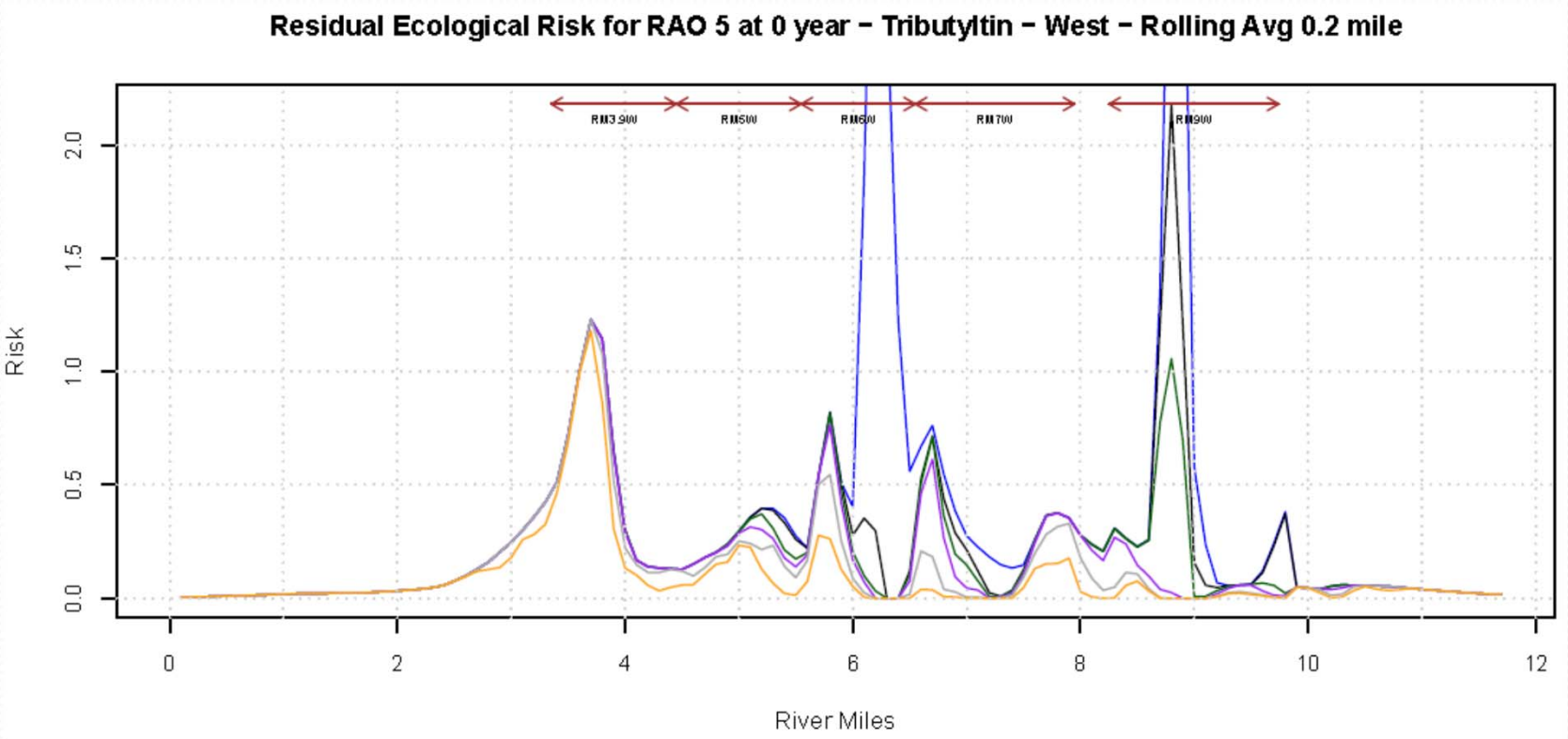
RAO 5 – Residual Risk



RAO 5 – Residual Risk



RAO 5 – Residual Risk



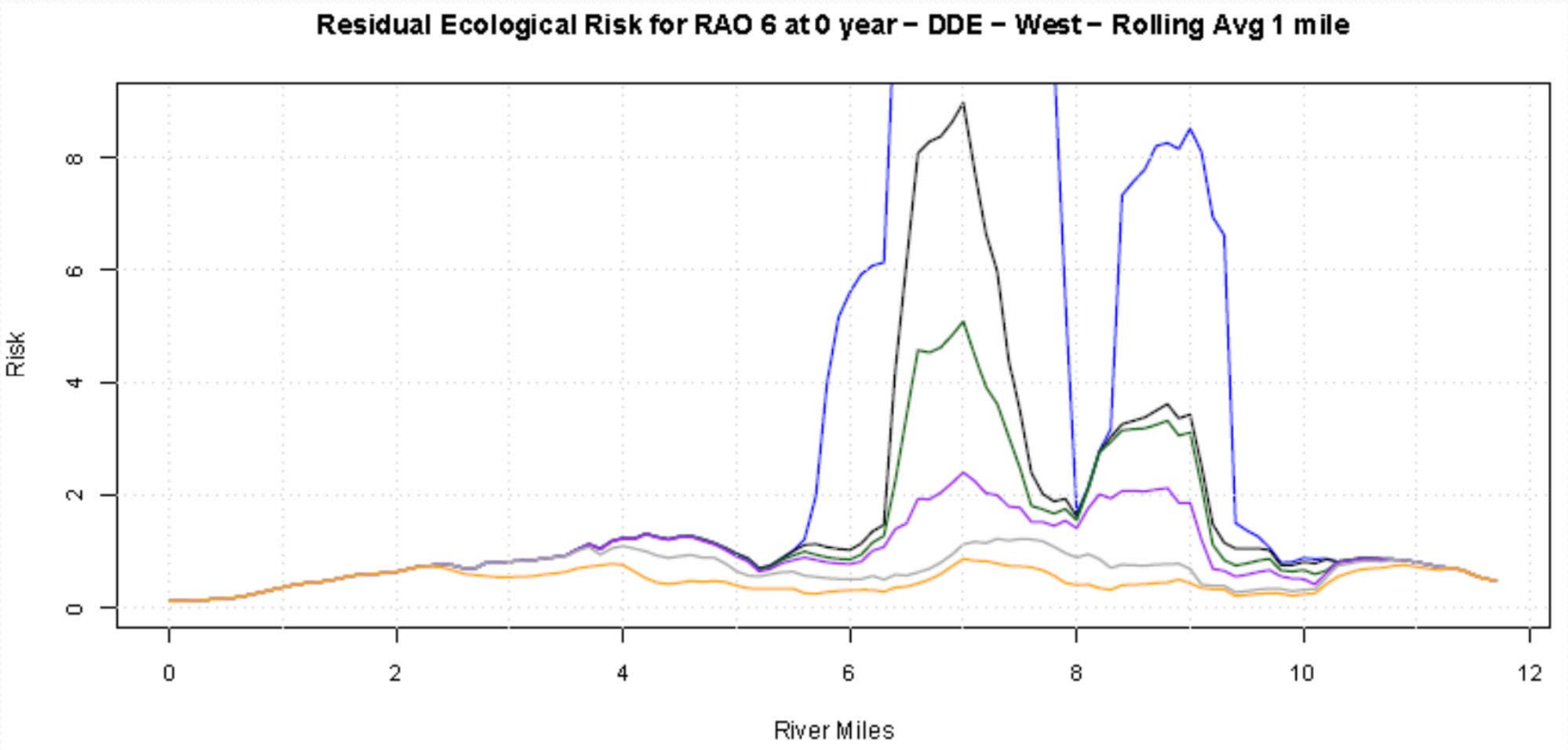
RAO 5 – Residual Risk @ t=0

NonCancer	Co.A	Co.B	Co.C	Co.D	Co.E	Co.F	Co.G
NoSDU	2	2	2	2	2	2	2
RM2E	3	2	2	2	2	1	1
RM3.5E	7	5	5	5	4	2	1
RM3.9W	4	4	4	4	4	3	2
RM4.5E	6	6	5	4	3	2	1
RM5W	3	3	2	2	2	1	1
RM5.5E	7	6	5	5	5	3	2
RM6Nav	15	4	4	3	2	1	0
RM6W	16	3	3	2	1	1	0
RM6.5E	6	4	4	4	3	3	2
RM7W	6	3	3	2	2	1	1
SwanIs	63	7	7	7	7	7	6
RM9W	8	5	4	4	2	1	0
RM11E	6	3	2	2	1	1	0

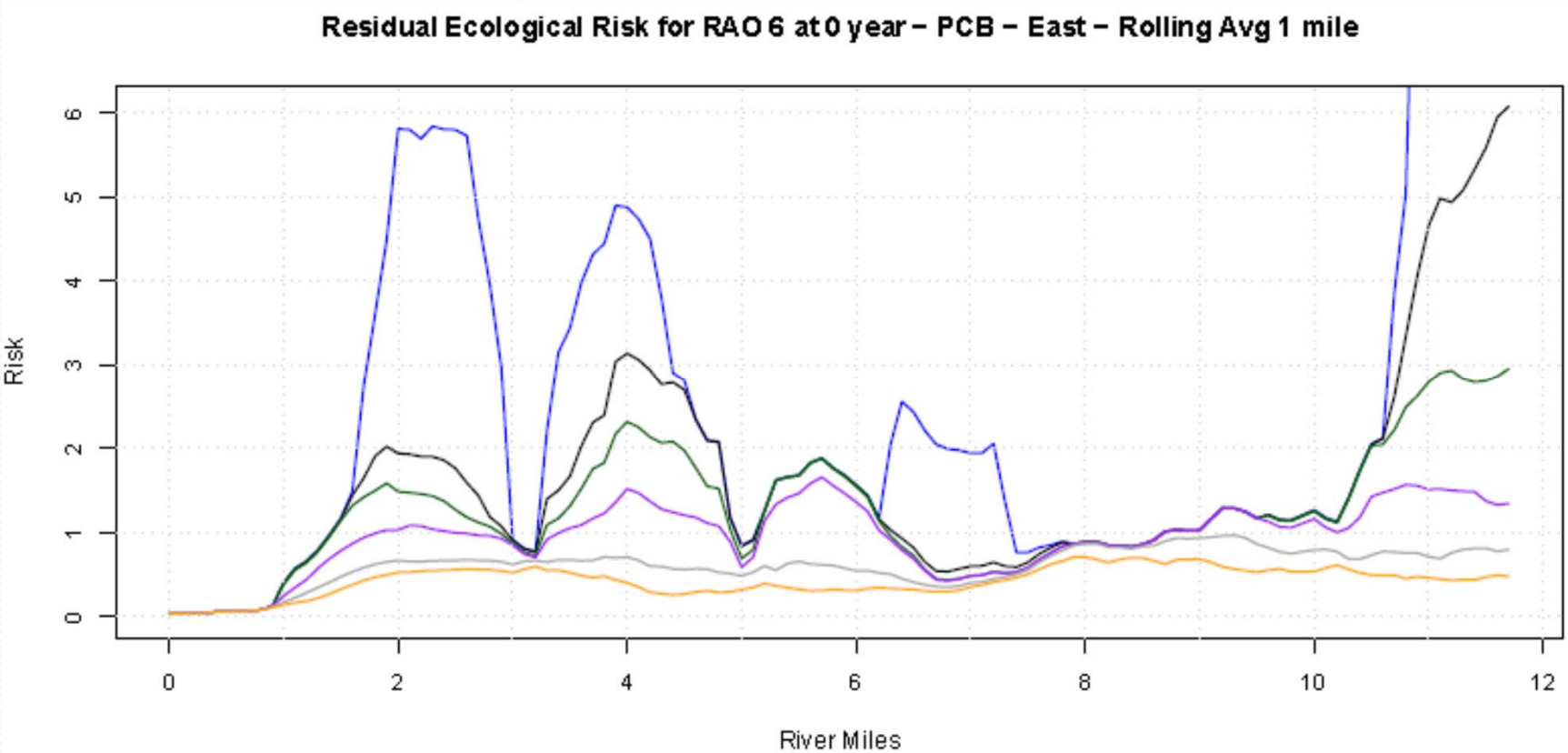
Residual Risk @ t=0 – RAO 6

- 3 of 8 PRGs met throughout site
- 5 PRGs <10x PRG
- RR/rolling RM – HQs < 5
- RR/SDU – HI < 5

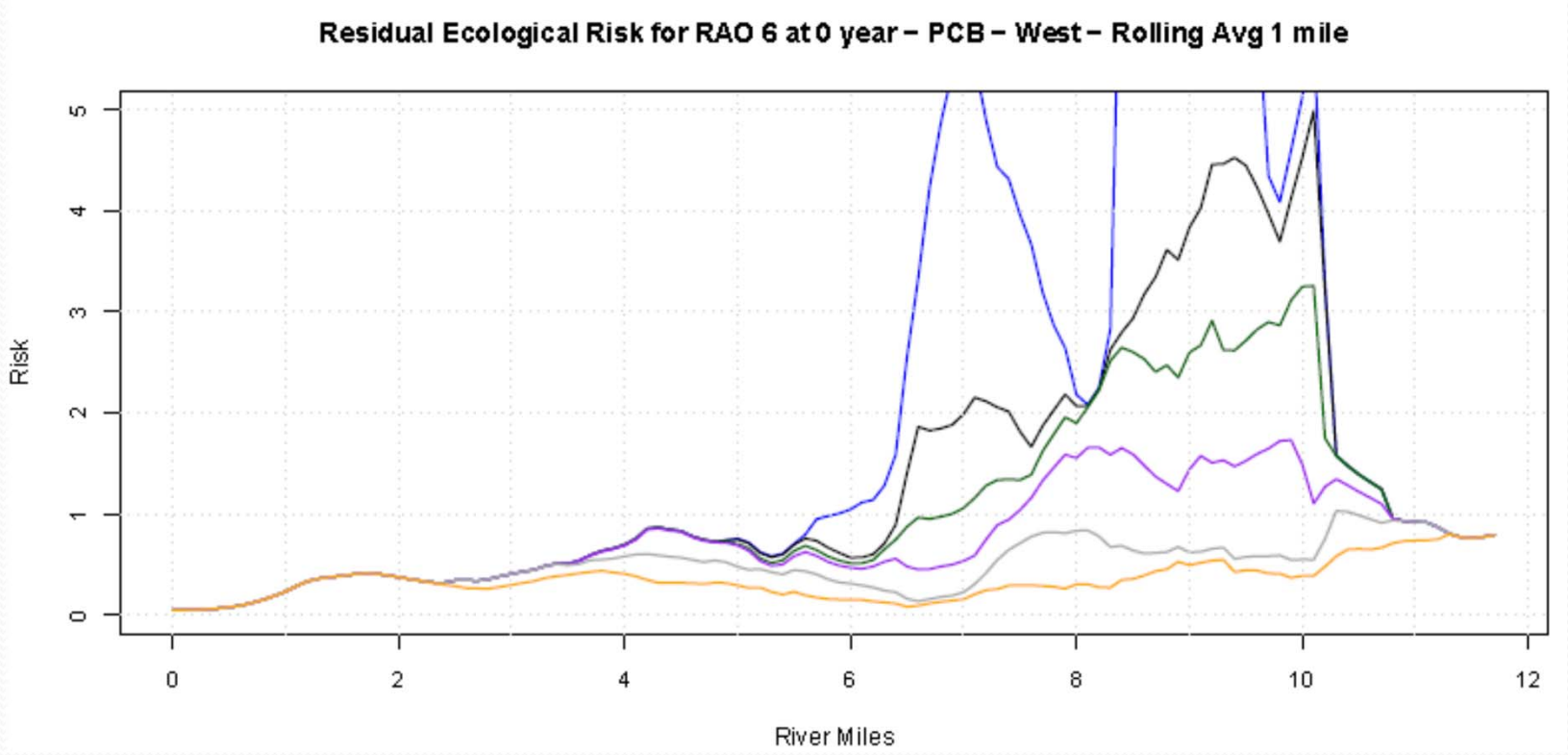
RAO 6 – Residual Risk



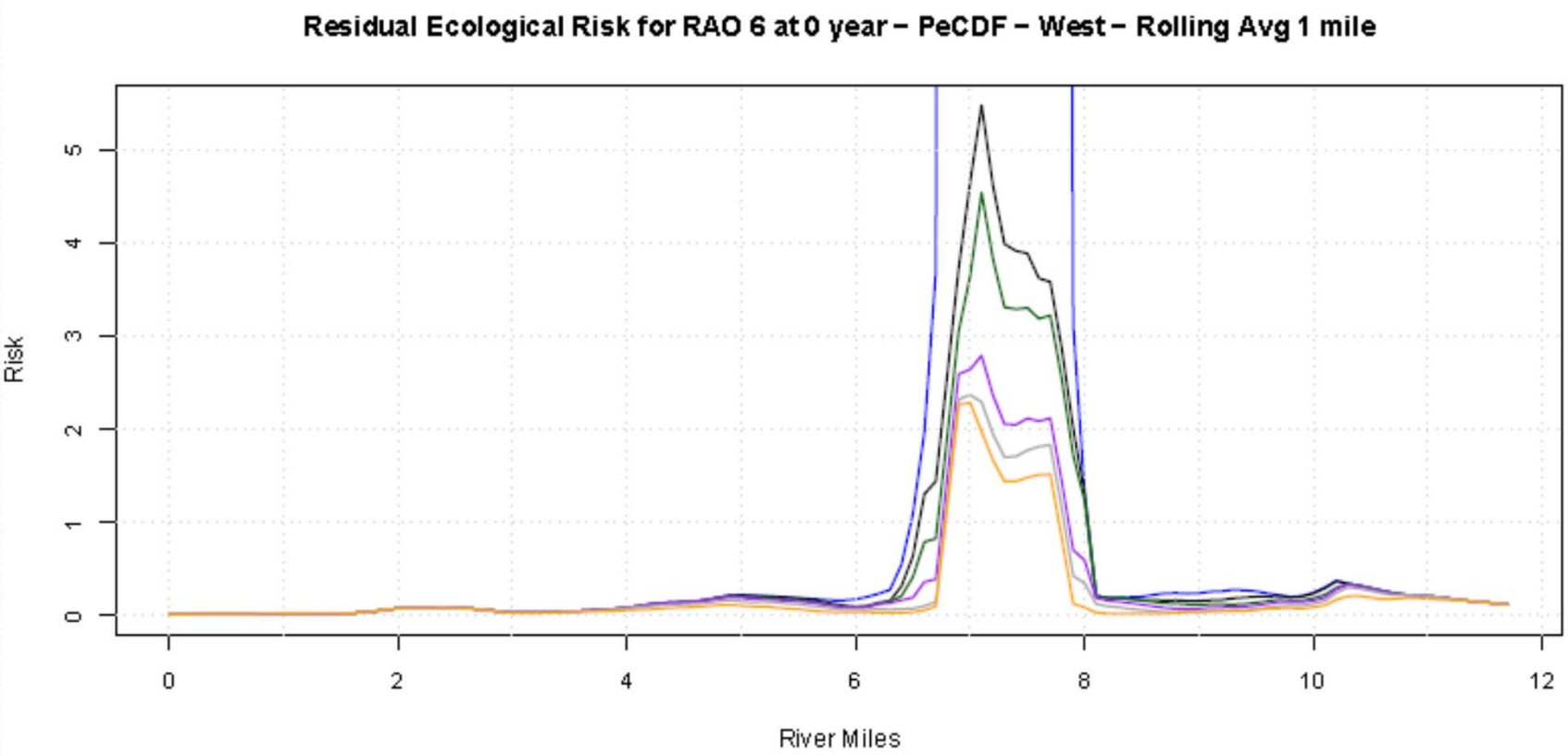
RAO 6 – Residual Risk



RAO 6 – Residual Risk



RAO 6 – Residual Risk



RAO 6 – Residual Risk @ t=0

NonCancer	Co.A	Co.B	Co.C	Co.D	Co.E	Co.F	Co.G
NoSDU	2	2	2	2	2	1	1
RM2E	6	3	3	2	2	2	1
RM3.5E	6	3	3	3	2	1	1
RM3.9W	2	2	2	2	2	2	1
RM4.5E	4	4	4	3	3	1	1
RM5W	3	3	3	2	2	2	1
RM5.5E	4	4	4	4	4	2	1
RM6Nav	3	2	2	2	2	1	0
RM6W	8	2	2	2	1	1	0
RM6.5E	5	3	3	3	3	2	2
RM7W	183	14	12	10	5	2	1
SwanIs	16	0	0	0	0	0	0
RM9W	15	7	7	6	3	1	1
RM11E	14	5	4	3	2	1	0

Other RAOs @ t=0

- RAOs 3 & 7
  - Compliance with Chemical Specific ARARs
- RAOs 4 & 8
  - Assume groundwater sources controlled
  - Added reactive layer to caps & residual layer
  - Cap model – cap thickness
- RAO 9
  - 61% riverbank contamination addressed

Compliance with ARARs

- Chemical specific ARARs
  - AWQCs – national and state
    - Assume all sources were controlled
    - Assume MNR will meet sediment PRGs
    - If PRGs met in surface sediment, would not contribute to exceedance
  - MCLs
    - Assume all groundwater plumes controlled
    - Reactive caps deal with residuals
  - WA Freshwater Sediment (TBC) – Benthic Risk
    - Ensure benthic risk due to CERCLA COCs addressed
  - Oregon Cleanup Laws
    - Meet at construction complete or with MNR
    - PRGs set at 10^{-6}, HQ=1, or background
    - Need ICs for background

Compliance with ARARs

- Action specific ARARs
  - CWA 404
    - Clean fill requirements for material
    - Mitigation/ESA
      - Required for all armored caps
      - Dredge/cap in nearshore
      - Beach mix nearshore and banks
      - Layback bank slope
  - Rivers & Harbors
    - No caps in federal navigation channel
    - Remove high concentration contamination
  - ODFW Management Plan (TBC)
    - Operations within work window (July 1 through October 31)

Compliance with ARARs

- Action Specific ARARs (cont.)
  - Disposal
    - Oregon Pesticide Rule
    - Oregon Solid Waste Rule
    - RCRA – OR delegated state
    - TSCA
  - CAA
    - Ensure emissions requirements during removal

Compliance with ARARs

- Location specific ARARs
  - ESA & EFH
    - Actions will not impede migration
    - Actions will not degrade habitat
  - FEMA
    - Net zero elevation in nearshore areas
  - NHPA & Indian Graves
    - No known areas
    - Artifacts are present throughout
    - Requirements during removal

Time to Achieve RAOs

- 7 years to construct remedy
  - RAO 1 cancer risks within risk range
  - RAO 2 cancer risks 10^{-3} (ICs)
  - All non-cancer risks within uncertainty (HI<10)
  - Infant will always have unacceptable risk (ICs)
- Allow 10 years MNR
  - Monitor all media

Institutional Control Assumptions

- Whole River
  - Fish consumption advisories
- Capped Areas
  - Waterway Use Restrictions or Regulated Navigation Areas (RNAs)
  - Land Use/Access Restrictions
- EMNR Areas
  - Land Use/Access Restrictions

FS Section 4

Optimized Alternative

Optimized Alternative

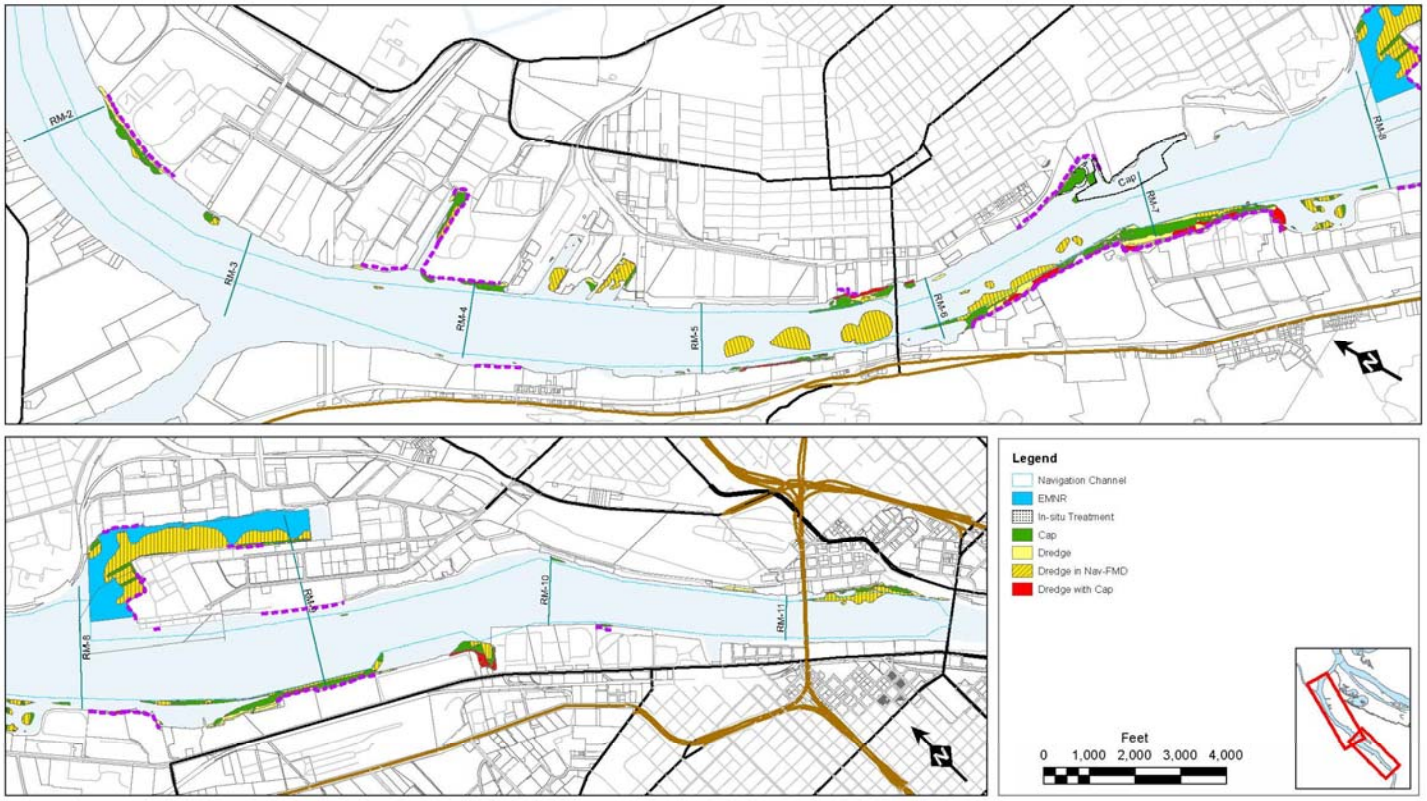


Figure 11-X. Selected Technology Assignments, Site-Wide

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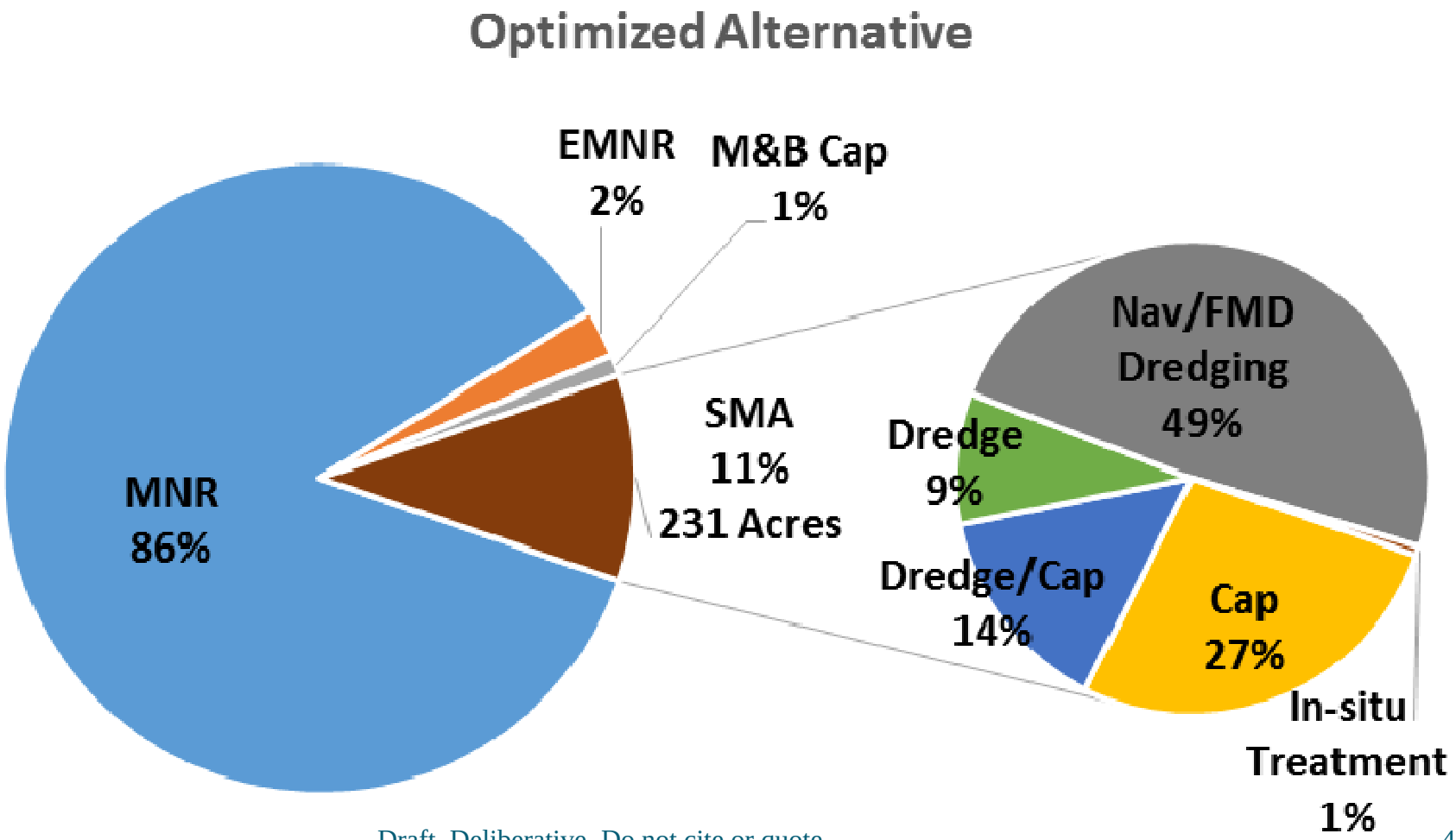
Optimized Technologies



Optimized Alternative Summary

- Dredge 167 acres
  - 1,888,900 cy
  - 455,000 cy ex-situ treatment
- Cap 83 acres
- EMNR 54 acres
- MNR 1,882 acres
- 16,596 lineal ft riverbank
  - Excavate 91,000 cy
  - Cap 20 acres
- 7 years
- $1.4 billion*

Objectives of Optimized Alternative @ t=0

- Address majority of PTW
- Meet PRGs for RAOs 5 & 6
- Minimize ICs for RAO 2
- Minimize recontamination from riverbanks
- Maintain fish consumption rates
- Minimize river use restrictions (caps)
- RAO 1 risks < 1×10^{-5}
- RAO 2 risks < 1×10^{-4} & HI < 10

Areas Modified from Alt. E

- SDU 5.5E – Alternative F
- SDU 6.5E – Alternative B + PTW
- SDU 6NAV – Alternative B + PTW
- SDU 6W – Alternative D
- SDU 7W – Alternative F
- Areas outside SDUs – PTW only

SDUs

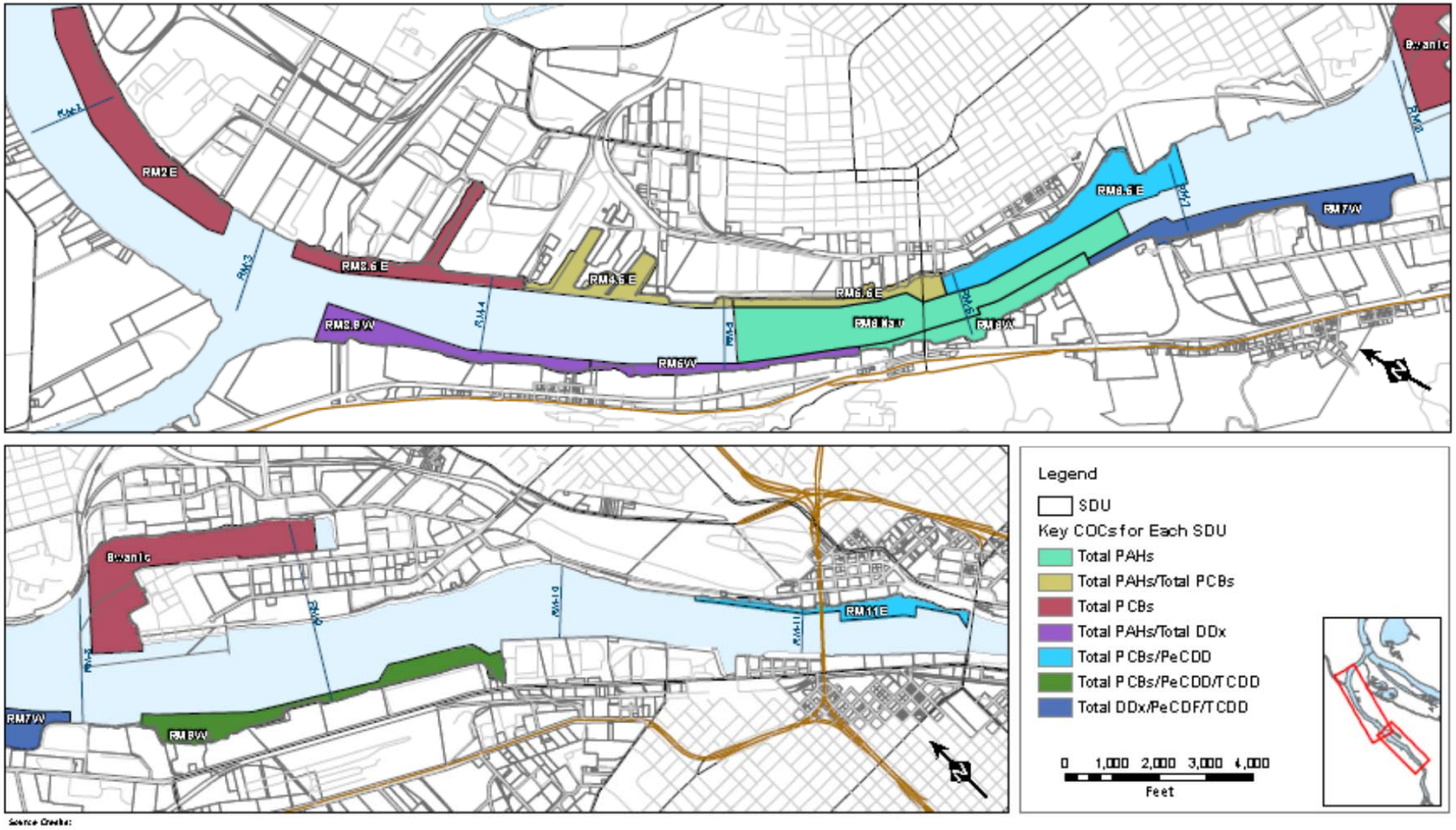


Figure 4.1-2. Sediment Decision Units and Key COCs

SDU 5.5E (cPAHs/Furans)

Alternative E

- RALs
  - PCBs = 200 ppb
  - PAH = 35,000 ppb
  - 2,3,4,7,8-PeCDF = 0.0008 ppb
- RAO 1 Residual risk 2 x 10^{-5}
- RAO 2 Residual risk 3 x 10^{-4}
- RAO 2 HI (child) = 12
- RAO 2 HI (infant) = 17,873
- Increased fish consumption = 14%
- RAO 5 HI = 5
- RAO 6 HI = 4

- Total Acres = 1

Alternative F

- RALs
  - PCBs = 75 ppb
  - PAH = 13,000 ppb
  - Furans = no change
- RAO 1 Residual risk 1 x 10^{-5}
- RAO 2 Residual risk 2 x 10^{-4}
- RAO 2 HI (child) = 6
- RAO 2 HI (infant) = 7,641
- Increased fish consumption = 63%
- RAO 5 HI = 3
- RAO 6 HI = 2

- Total Acres = 9

SDU 6.5E (cPAHs, PCBs, Dioxins)

Alternative E

- RALs
  - PAHs = 35,000 ppb
  - PCBs = 200 ppb
  - 1,2,3,7,8-PeCDD = 0.2 ppb
  - 2,3,7,8-TCDD = 0.0006 ppb
- RAO 1 Residual risk 6 x 10^{-6}
- RAO 2 Residual risk 2 x 10^{-4}
- RAO 2 HI (child) = 6
- RAO 2 HI (infant) = 9,929
- Increased fish consumption = 64%
- RAO 5 HI = 3
- RAO 6 HI = 3

- Total Acres = 14

Alternative B + PTW

- RALs
  - PAHs = 170,000 ppb
  - PCBs = 200 ppb
  - 1,2,3,7,8-PeCDD = 0.01 ppb
  - 2,3,7,8-TCDD = 0.02 ppb
- RAO 1 Residual risk 7 x 10^{-6}
- RAO 2 Residual risk 2 x 10^{-4}
- RAO 2 HI (child) = 7
- RAO 2 HI (infant) = 11,000
- Increased fish consumption = 61%
- RAO 5 HI = 4
- RAO 6 HI = 3

- Total Acres = 8

SDU 6NAV (PAHs)

Alternative E

- RALs
  - PAHs = 35,000 ppb
- RAO 2 Residual risk 1 x 10^{-4}
- RAO 2 HI (child) = 3
- RAO 2 HI (infant) = 5,560
- Increased fish consumption = 45%
- RAO 5 HI = 2
- RAO 6 HI = 2

- Total Acres = 67

Alternative B + PTW

- RALs
  - PAHs = 170,000 ppb
- RAO 2 Residual risk 1 x 10^{-4}
- RAO 2 HI (child) = 5
- RAO 2 HI (infant) = 8,100
- Increased fish consumption = 20%
- RAO 5 HI = 4
- RAO 6 HI = 3

- Total Acres = 29

SDU 6W (cPAHs)

Alternative E

- RALs
  - PAHs = 35,000 ppb
- RAO 1 Residual risk 8 x 10^{-6}
- RAO 2 Residual risk 7 x 10^{-5}
- RAO 2 HI (child) = 3
- RAO 2 HI (infant) = 4,445
- Increased fish consumption = 67%
- RAO 5 HI = 1
- RAO 6 HI = 1

- Total Acres = 21

Alternative D

- RALs
  - PAHs = 69,000 ppb
- RAO 1 Residual risk 1 x 10^{-5}
- RAO 2 Residual risk 9 x 10^{-5}
- RAO 2 HI (child) = 3
- RAO 2 HI (infant) = 5,293
- Increased fish consumption = 61%
- RAO 5 HI = 2
- RAO 6 HI = 2

- Total Acres = 19

SDU 7W (Furans)

Alternative E

- RALs
  - 2,3,4,7,8-PeCDF = 0.0008 ppb
  - DDx = 300 ppb
- RAO 1 Residual risk 4×10^{-6}
- RAO 2 Residual risk 3×10^{-4}
- RAO 2 HI (child) = 10
- RAO 2 HI (infant) = 10,579
- Increased fish consumption = 78%
- RAO 5 HI = 2
- RAO 6 HI = 5

- Total Acres = 27

Alternative F

- RALs
  - Furans = no change
  - DDx = 160 ppb
- RAO 1 Residual risk 2×10^{-6}
- RAO 2 Residual risk 2×10^{-4}
- RAO 2 HI (child) = 5
- RAO 2 HI (infant) = 6,060
- Increased fish consumption = 87%
- RAO 5 HI = 1
- RAO 6 HI = 2

- Total Acres = 38