Portland Harbor FS Sections 3 & 4

Presentation to the
Lower Willamette Group
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Objectives

* Development of the Alternatives
* Screening of the Alternatives
* Detailed Analysis
* Comparative Analysis

FS Section 3

Development of Alternatives

Development of Alternatives

- Combination of technologies
  - Used for all alternatives, except Alternative A
- Technologies include:
  - Dredging
  - Capping
  - In-situ treatment
  - Ex-situ treatment
  - EMNR
  - MNR
  - ICs

Treatment Assumptions

* PTW and groundwater plumes
* In-situ Treatment
  - Activated carbon
  - Organophilic clay
  - Solidification/stabilization (under structures)
* Ex-situ Treatment
  - Thermal desorption

Principal Threat Waste

- Source Material - NAPL
  - Chlorobenzene - Arkema
  - PAHs - Gasco

- Highly Toxic– exceeds 10^{-3}
  - PCBs > 200 µg/kg
  - cPAHs > 100,000 µg/kg
  - DDx > 7000 µg/kg
  - 2,3,7,8-TCDD > 0.02 µg/kg
  - 2,3,7,8-TCDF > 4 µg/kg
  - 1,2,3,7,8-PeCDD > 0.01 µg/kg
  - 2,3,4,7,8-PeCDF > 0.4 µg/kg
  - 1,2,3,4,6,7,8-HxCDF >0.3 µg/kg

PTW – Reliably Contained

Contaminant	PTW Contaminants Reliably Contained
Dioxins/Furans	Can be reliably contained
PAHs	Can be reliably contained
Chlorobenzene	<320 µg/kg
DDx	Can be reliably contained
Naphthalene	<140,000 µg/kg
PCBs	Can be reliably contained

Ex-situ Treatment Assumptions

* NAPL & PTW Not Reliably Contained
  * Chlorobenzene
  * Napthalene
  * PAHs
  * DDx mixed with chlorobenzene
* Treatment Method
  * Thermal Desorption

SMA Technologies Considered

* Caps
* Dredging & Excavation
* Dredge/Cap
* Institutional Controls

Sediment Management Areas

* Based on RALs for Focused COCs
  - PCBs
  - Total PAHs
  - 1,2,3,7,8-PeCDD
  - 2,3,4,7,8-PeCDF
  - 2,3,7,9-TCDD
  - DDx
* Change throughout the alternatives

Remedial Action Levels

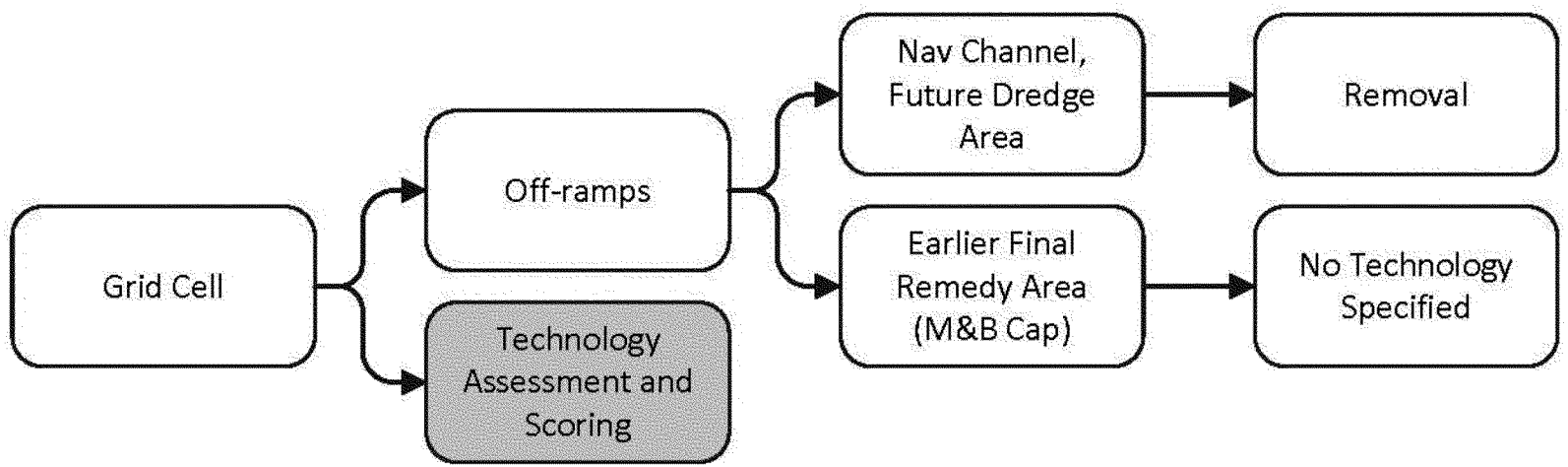
Contaminant	B	C	D	E	F	G
PCBs	1,000	750	500	200	75	50
Total PAHs*	170,000	130,000	69,000	35,000	13,000	5,400
1,2,3,7,8-PeCDD	1	1	1	0.2	0.2	0.009
2,3,4,7,8-PeCDF	0.003	0.002	0.0008	0.0008	0.0008	0.0008
2,3,7,9-TCDD	0.002	0.002	0.002	0.0006	0.0006	0.0006
DDx	650	550	450	300	160	40

*Equivalent to cPAH RALs in draft FS.
All units µg/kg.

Multi-Criteria Decision Matrix

- Unbiased and reproducible method
- Based on multiple site characteristics
- Uses 10' x 10' grid cells
  - Technology assigned to grid cell
  - Predominant technology w/ smoothing algorithm
- Scored based on multiple criteria
  - Hydrodynamics
  - Sediment bed characteristics
  - Anthropogenic conditions

Technology Assignment Decision Tree



Technology Assignment Scoring Matrix

- Criteria Scoring
  - +1 = technology favorable
  - 0 = technology neutral
  - -1 = technology unfavorable
  - NC = not applicable

Technology Assessment Scoring		Dredge	Armor Cap	EMNR/ Cap
Hydrodynamics	Wind/Wave Zone?	1	0	NC
	Erosive?			-1
	Depositional? (<2.5cm/year or Subsurface:Surface Ratio>2)?	-1	1	1
	Shallow?	1	-1	0
Sediment Bed Characteristics	Slope 15-30%?	1	1	NC
	Slope >30%		0	
	Rock, Cobble, Bedrock Present?	-1	1	1
Anthropogenic Influences	Structures/Pilings?	-1	1	1
	Prop Wash Zone?	1	0	NC
	Moderate or Heavy Debris?	-1	0	1
	Technology Score	Sum Scores for Each Technology		

Delineated Areas for Technology Assignment

- **Navigation Channel & FMD**
  - Dredging (consistent with LWG Draft FS)
- **Shallow (>4 feet NAVD88)**
  - Dredge/cap
  - Armor with beach mix
- **Intermediate (between Nav Channel and Shallow)**
  - Dredge
  - Cap

Cap Design Assumptions

- Engineered Cap
  - Shallow Areas
    - Physical Isolation Layer: 30 in. sand
    - Stabilization Layer: 6 in. beach mix
  - Intermediate Areas
    - Physical Isolation Layer: 36 in. sand
- Armored Cap
  - Physical Isolation Layer: 24 in. sand
  - Stabilization Layer: 12 in. armor stone

Cap Design Assumptions (cont.)

- Reactive Cap
  - Shallow Areas
    - Chemical Isolation Layer: 12-in. sand w/ 5% AC or organophilic clay
    - Physical Isolation Layer: 18 in. sand
    - Stabilization Layer: 6 in. beach mix
  - Intermediate Areas
    - Chemical Isolation Layer: 12-in. sand w/ 5% AC or organophilic clay
    - Physical Isolation Layer: 24 in. sand

Cap Design Assumptions (cont.)

* Armored Reactive Cap
  - Chemical Isolation Layer: 12-in. sand w/ 5% AC or organophilic clay
  - Physical Isolation Layer: 12 in. sand
  - Stabilization Layer: 12 in. armor stone
* Significantly Augmented Reactive Cap
  - Chemical Isolation Layer: 12-in. sand w/ 20% AC
  - Low Permeability Layer: clay (e.g., AquaBlok)
  - Physical Isolation Layer: 18 in. sand
  - Stabilization Layer: 6 in. armor stone
* Institutional Controls

Dredging Assumptions

* Equipment
  - Environmental/closed bucket
  - Articulated fixed-arm dredge w/50 feet arm
  - 2 cu yd bucket around and under structures
  - 4 cu yd bucket
* Productivity
  - 123 days/year (July 1 through October 31)
  - 24 hours/6 days per week

Dredging Assumptions (cont.)

* Accuracy
  - Natural Neighbors Geostatistical Interpolation
  - Depth based on RALs
  - Maximum dredge depth 15-19 feet
* Residuals
  - 12 in. sand
* Resuspension
  - Silt curtains
  - Rigid containment – NAPL (<50 ft water)

Caps

Alternative	Engineered Cap	Armored Cap	Reactive Cap	Reactive Armored Cap
	Acres			
B	0.9	2.8	0	5.5
C	1.7	4.5	0	6.7
D	4.0	8.9	0	10
E	4.8	14	0	15
F	13	48	0	29
G	24	101	0	39

Dredge and Dredge/Cap Intermediate and NAV/FMD

Alternative	Residual Layer	Reactive Residual Layer	Reactive Cap	Reactive Armored Cap	Significantly Augmented Reactive Cap
	Acres				
B	19	47	0	2.5	0.8
C	25	56	0	2.9	1.0
D	44	80	0	5.2	1.2
E	60	133	0	8.7	1.6
F	209	148	0	15	2.2
G	357	169	0	16	2.3

Dredge and Dredge/Cap Shallow

Alternative	Backfill	Reactive Residual Layer	Engineered Cap	Reactive Cap	Significantly Augmented Reactive Cap
	Acres				
B	1.7	8.3	0	0.5	1.0
C	2.0	10	1.1	0.6	1.1
D	4.3	12	2.6	1.1	1.1
E	4.1	22	3.4	1.8	1.4
F	11	18	14	5.3	1.4
G	19	18	15	8.7	1.4

Disposal Assumptions

- NAPL & Not Reliably Contained
  - Subtitle C
- Alternatives B, C & D
  - Off-site disposal
  - Subtitle D
- Alternatives E, F & G
  - DMM Scenario 1: CDF & off-site disposal
  - DMM Scenario 2: Off-site disposal

EMNR Assumptions

- Swan Island Lagoon
  - Outside SMAs
  - 12 in. sand
- Institutional Controls

Remaining Areas

- In-situ treatment for PTW
  - Only if depositional area
  - Activated carbon
- MNR
  - Deposition
  - Dispersion
- Institutional Controls

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

Summary of Technology Assignments

Alt	Dredge Volume	Dredge Areas	Dredge/Cap Areas	Cap Areas	In-Situ Areas	Ex-Situ Volume	EMNR	MNR[3]	Disposal	Years to Const.
	(Cu Yd)	(Acres)	(Acres)	(Acres)	(Acres)	(Cu Yd)	(Acres)	(Acres)		
B	614,000 to 819,000	70	11	9	7	161,000	103	2,250	DMM 2	4
C	762,000 to 1,016,000	86	15	13	5	177,000	101	2,231	DMM 2	4
D	1,173,000 to 1,564,000	131	21	22	3	198,000	88	2,185	DMM 2	5
E	2,061,000 to 2,749,000	203	33	34	0	216,000	59	2,121	DMM 1 DMM 2	7
F	4,383,000 to 5,843,000	374	50	90	0	248,000	24	1,912	DMM 1 DMM 2	12
G	6,865,000 to 9,154,000	544	73	163	0	259,000	15	1,655	DMM 1 DMM 2	18

Alternative B

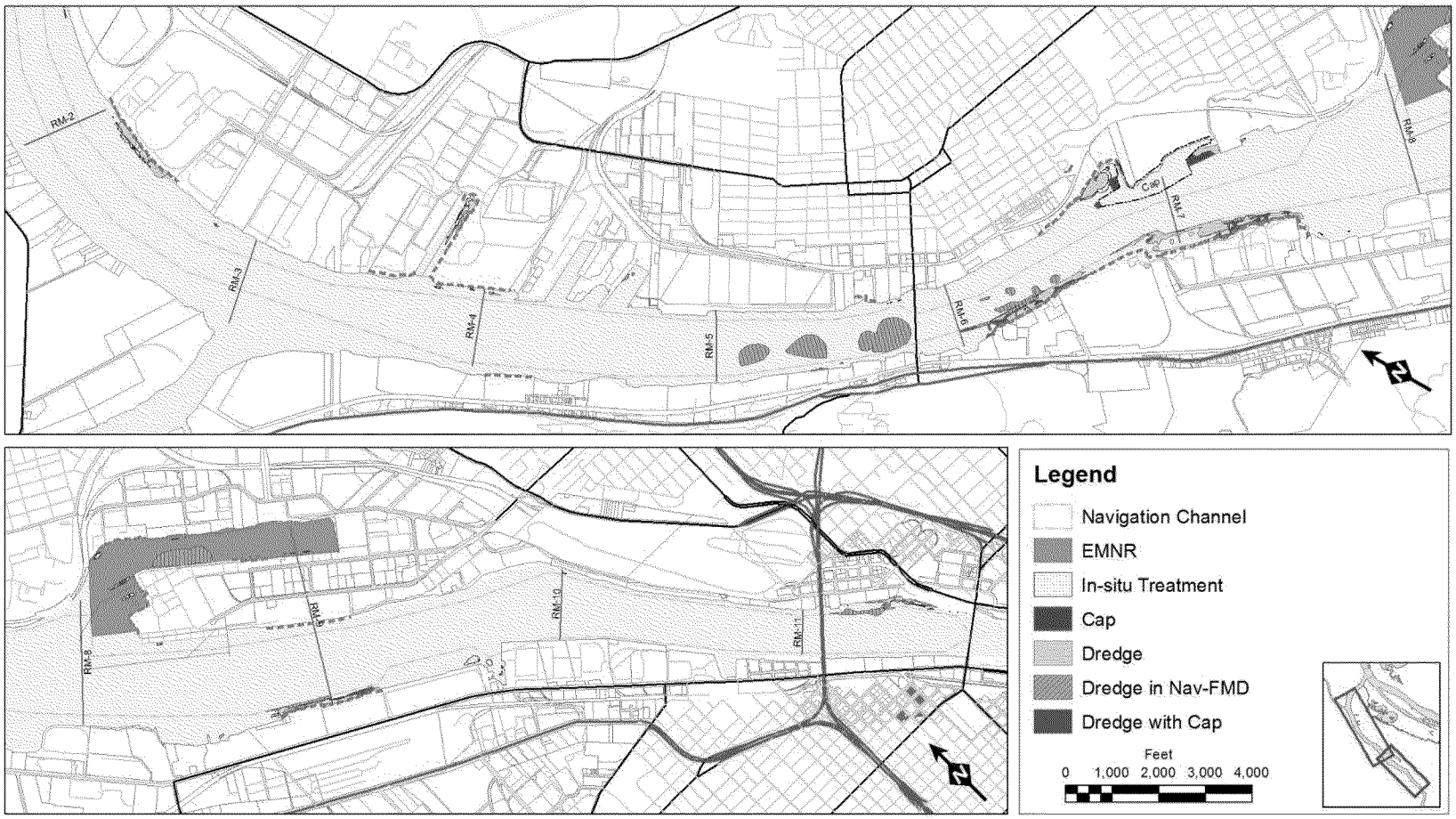


Figure 3.6-2a. Technology Assignments, Alternative B, Site-Wide

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Alternative C

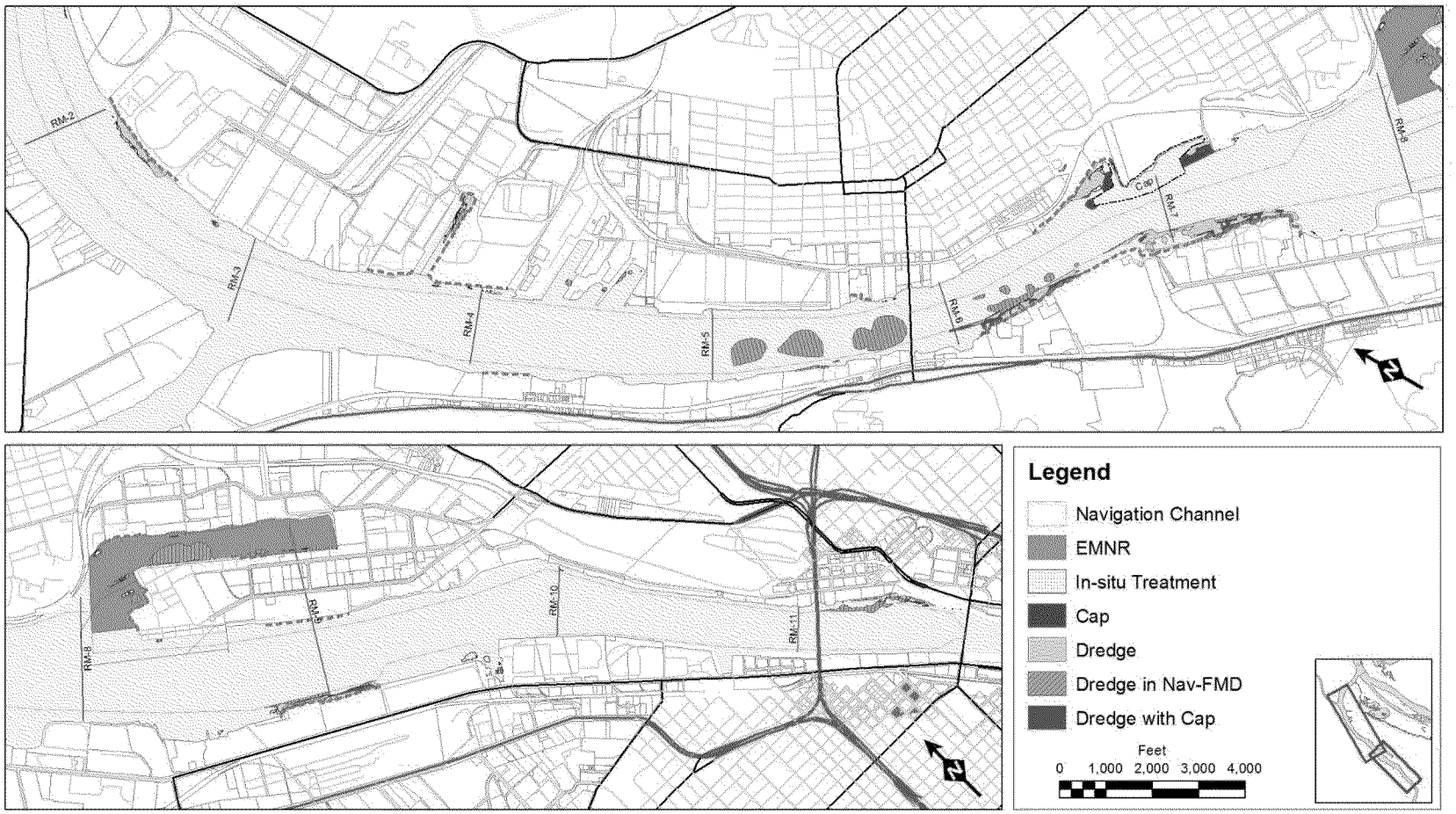

Figure 3.6-3a. Technology Assignments, Alternative C, Site-Wide

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Date: 7/27/2016

Alternative D

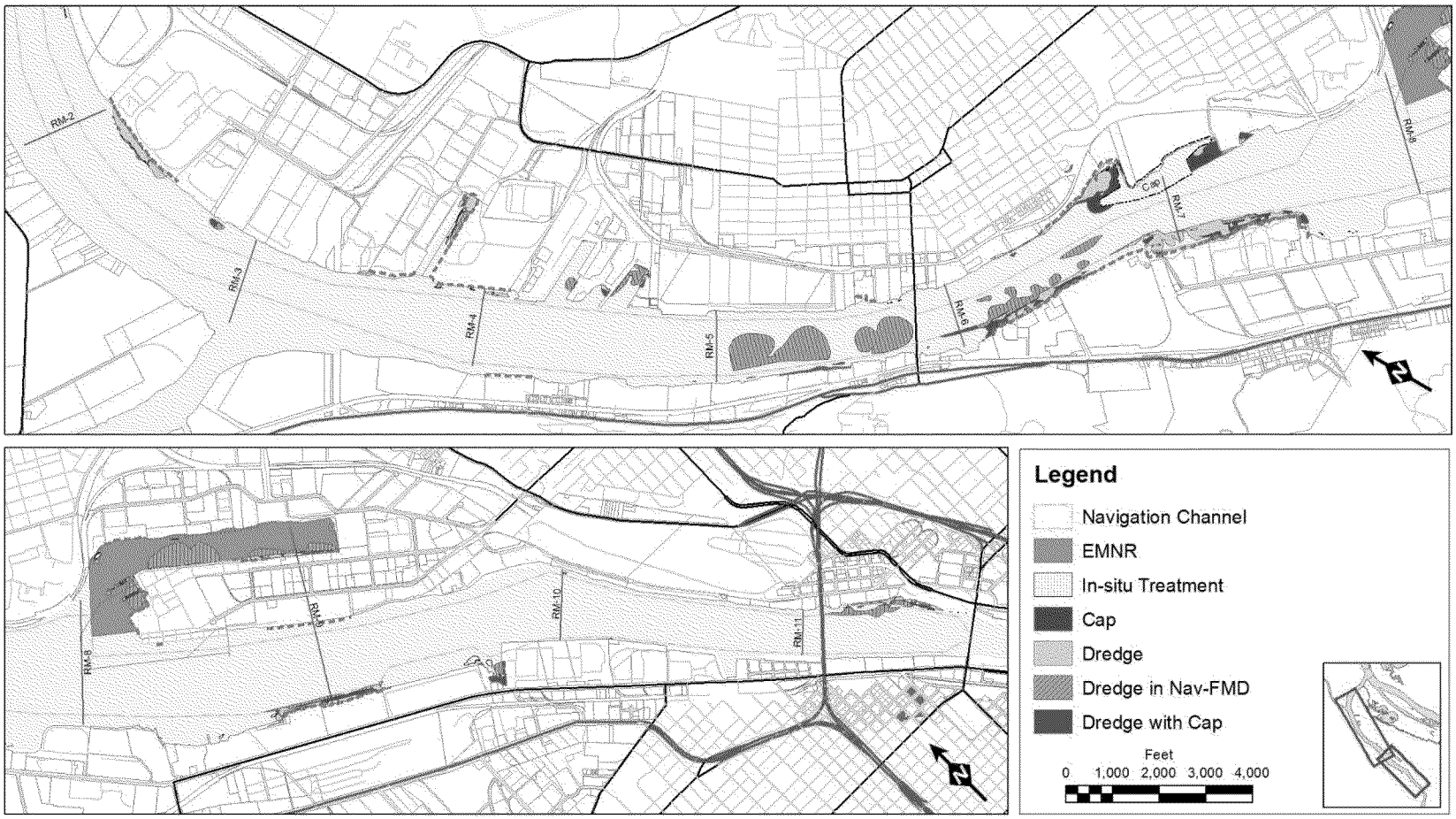

Figure 3.6-4a. Technology Assignments, Alternative D, Site-Wide

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Alternative E

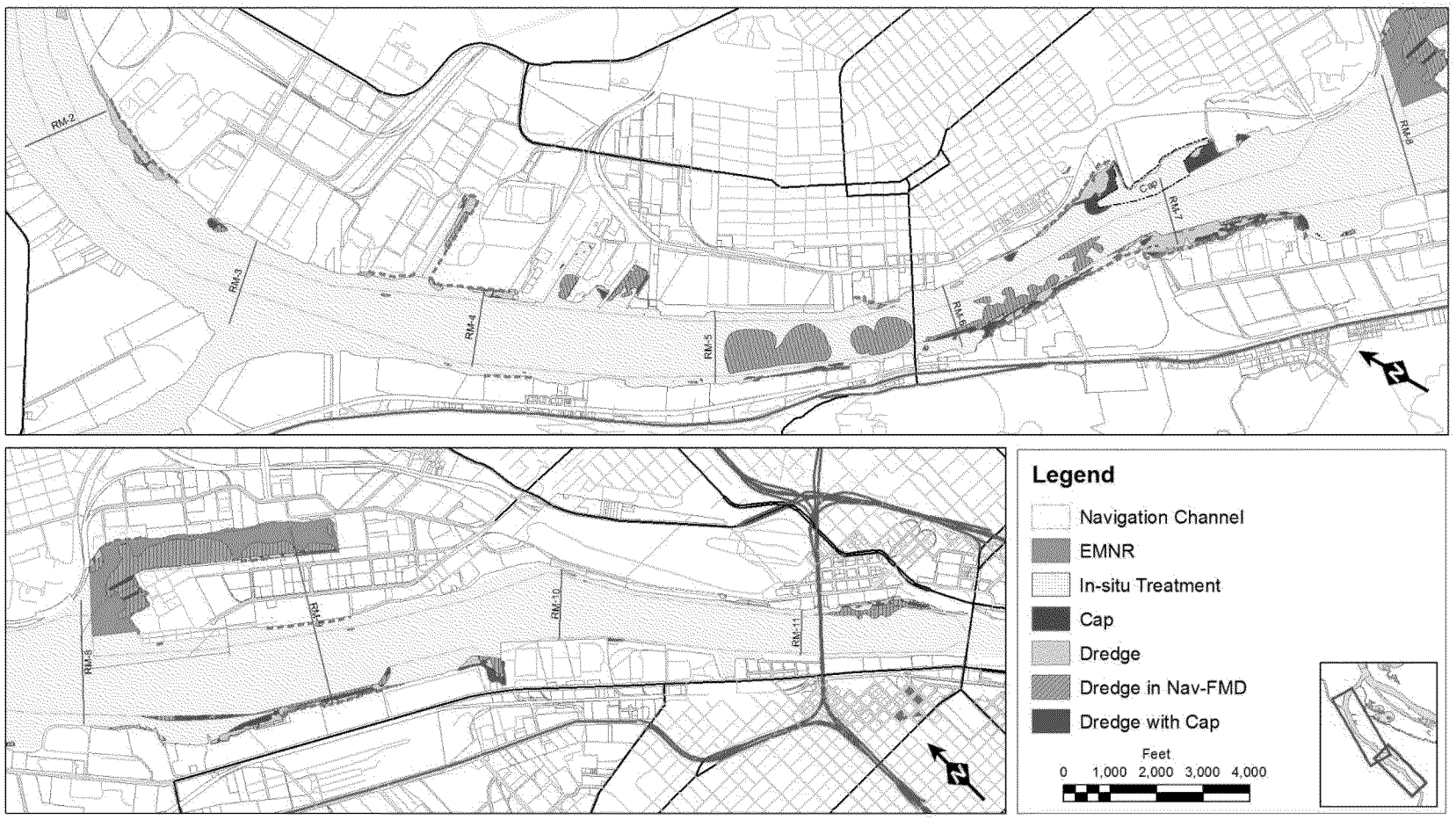

Figure 3.6-5a. Technology Assignments, Alternative E, Site-Wide

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Alternative F

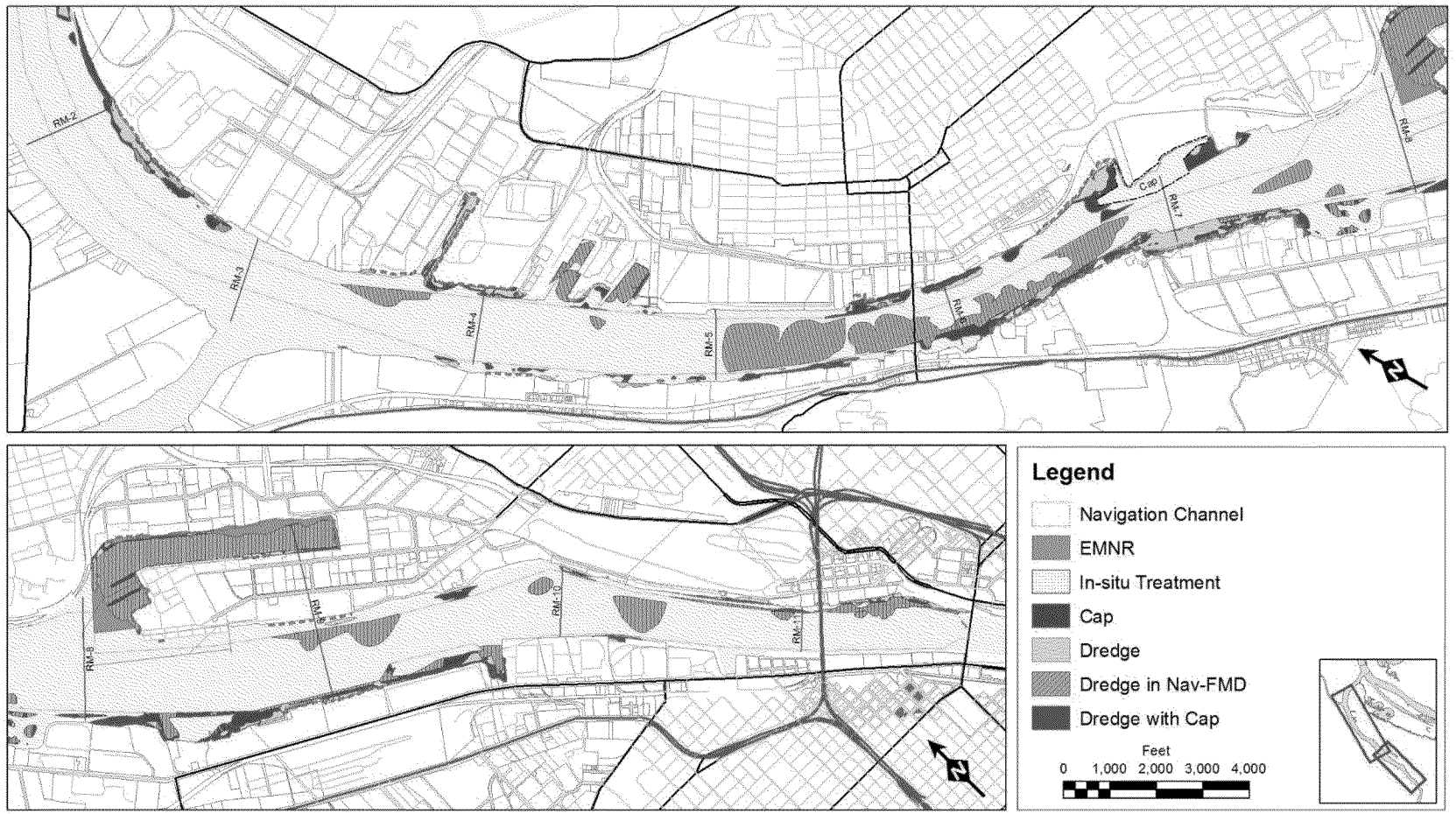

Figure 3.6-6a. Technology Assignments, Alternative F, Site-Wide

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Date: 7/23/2015

Alternative G

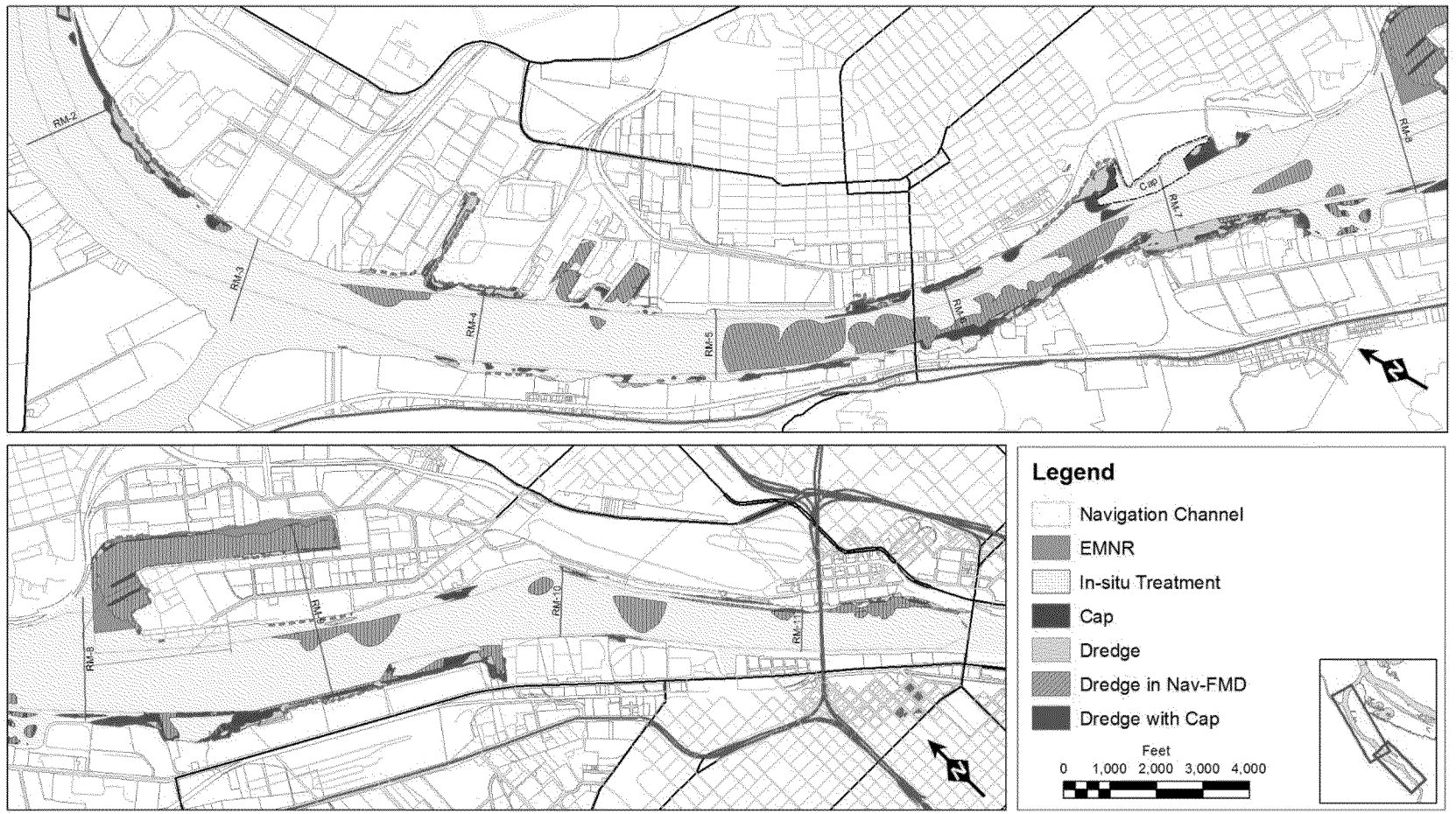

Figure 3.6-6a. Technology Assignments, Alternative F, Site-Wide

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Date: 3/27/2015

FS Section 3

Screening of Alternatives

Screened Alternatives

- Alternative C
  - Essentially same as Alternative B
  - 0.1% increase in overall acres remediated
  - 8.7% reduction of focused COC concentrations

FS Section 4

Detailed Analysis

NCP Criteria

- Threshold criteria
  - Overall Protection of Human Health and the Environment
  - Compliance with ARARs
- Balancing criteria
  - Long-Term Effectiveness and Permanence
  - Reduction of Toxicity, Mobility or Volume through Treatment
  - Short-Term Effectiveness
  - Implementability
  - Cost

Overall Protection of Human Health and the Environment

- Draws on
  - Compliance with ARARs
  - Long-Term Effectiveness and Permanence
  - Short-Term Effectiveness
- Human Health
  - Compare to PRGs for RAOs 1 & 2
  - Qualitative for RAOs 3 & 4
- Ecological
  - Compare to PRGs for RAOs 5 & 6
  - Benthic Risk
  - Qualitative for RAOs 7 & 8

Compliance with ARARs

- Ensure alternative meets all
  - Chemical specific ARARs
    - AWQCs – national and state
    - MCLs
    - Oregon Cleanup Laws
    - Oregon Hazardous Substance Laws
  - Action specific ARARs
    - ESA & EFH
    - FEMA
    - NHPA & Indian Graves
  - Location specific ARARs
    - CWA 404
    - Rivers & Harbors Act
    - RCRA
    - Oregon Hazardous Waste & Solid Waste
    - Oregon Water Quality Standards
    - TSCA

Long-term Effectiveness and Permanence

- Magnitude of Residual Risk
  - Human Health
    - Rolling river mile by three zones
    - Cancer risks for adult
    - Noncancer hazards for child and infant
  - Ecological
    - Same as HH
    - Most sensitive receptor
- Adequacy and Reliability of Controls
  - Engineering and Institutional Controls
- Repairs, Maintenance and Remedy Replacement

Reduction in Toxicity, Mobility & Volume by Treatment

- Treatment processes used
- Amount destroyed or treated
  - principal threat wastes
- Expected reduction
- Irreversible treatment
- Type and quantity remaining

Short-term Effectiveness

- Time to Complete Remedy
  - Time for construction
  - Time until RAOs achieved
- Community Protection
  - Transport of wastes and materials
  - "Quality of life issues" from construction
  - Impacts until RAOs achieved
- Worker Protection
  - Risks with construction activities
- Environmental Impacts
  - Effects of construction activities
  - Impacts until RAOs achieved

Time to RAOs

- Data (concentrations)
  - RM 16 and 11W sediment traps
    - Mean
    - 95th percentile
    - 5th percentile
- Deposition Rates
  - 4 site-wide rates used by LWG
- SedCam Model
- Spatial Scales
  - SDU
  - River Zones
  - Site-wide

Implementability

- Ability to construct and operate
- Ease of doing more if needed
- Ability to monitor effectiveness
- Other offices or agencies
  - Obtain approvals
  - Coordinate
- Availability
  - Specialists
  - Equipment
  - Materials
  - Technologies

Costs

- Capital
  - Construction
- Annual O&M
  - Monitoring
  - Cap maintenance
- Periodic
  - 5-year reviews
  - Cap replacement
- Present value
  - No discount
  - 7% discount

Not a "cost-benefit" analysis

FS Section 4

Comparative Analysis

Qualitative Comparative Analysis

Remedial Alternative	Description	Threshold Criteria		Balancing Criteria				
		Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume through Treatment	Short-Term Effectiveness	Implementability	Present Value Cost (Dollars)
Contaminated Sediment Alternatives								
A	No Action/No Further Action	—	—	NA	NA	NA	NA	NA
B	Dredge 83 acres; Contain 4 acres Dredge/Cap 3 acres; EMNR 103 acres MNR 2,250 acres; In-situ 7 acres Ex-situ 321,120 cy; Disposal 892,000 cy	*	*	○	◔	◔	●	$
D	Dredge 161 acres; Contain 7 acres Dredge/Cap 6 acres; EMNR 88 acres MNR 2,185acres; In-situ 3 acres Ex-situ 395,060 cy; Disposal 1,766,000 cy	*	*	◔	◑	◔	◕	$
E	Dredge 249 acres; Contain 10 acres Dredge/Cap 10 acres; EMNR 60 acres MNR 2,121 acres; In-situ 0 acres Ex-situ 431,560 cy; Disposal 3,100,000 cy	*	*	◑	◕	●	◑	$$
F	Dredge 479 acres; Contain 18 acres Dredge/Cap 17 acres; EMNR 24 acres MNR 1,913 acres; In-situ 0 acres Ex-situ 495,830 cy; Disposal 7,115,000 cy	*	*	◕	●	◕	◔	$$$
G	Dredge 741 acres; Contain 22 acres Dredge/Cap 18 acres; EMNR 15 acres MNR 1,655 acres; In-situ 0 acres Ex-situ 518,010 cy; Disposal 11,722,000 cy	*	*	●	●	◑	○	$$$$