

VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

3D Relative Risk Profile Comparison
Potential Grounding Oil Loss

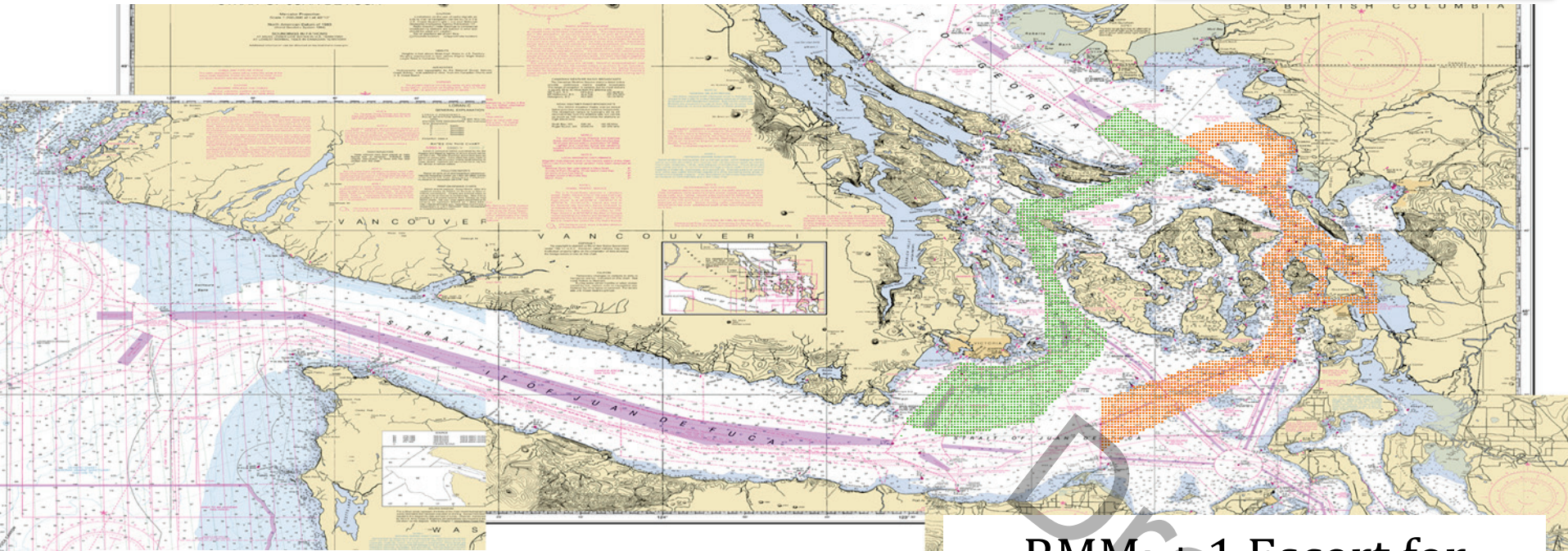
**CASE T: GW – KM – DP & +1 Escort Rosario – Laden
Tankers, Chem. Carrier, ATB & Cape Size Bulker**

Dr. J. Rene van Dorp and Dr. Jason R.W Merrick

November 2013



VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

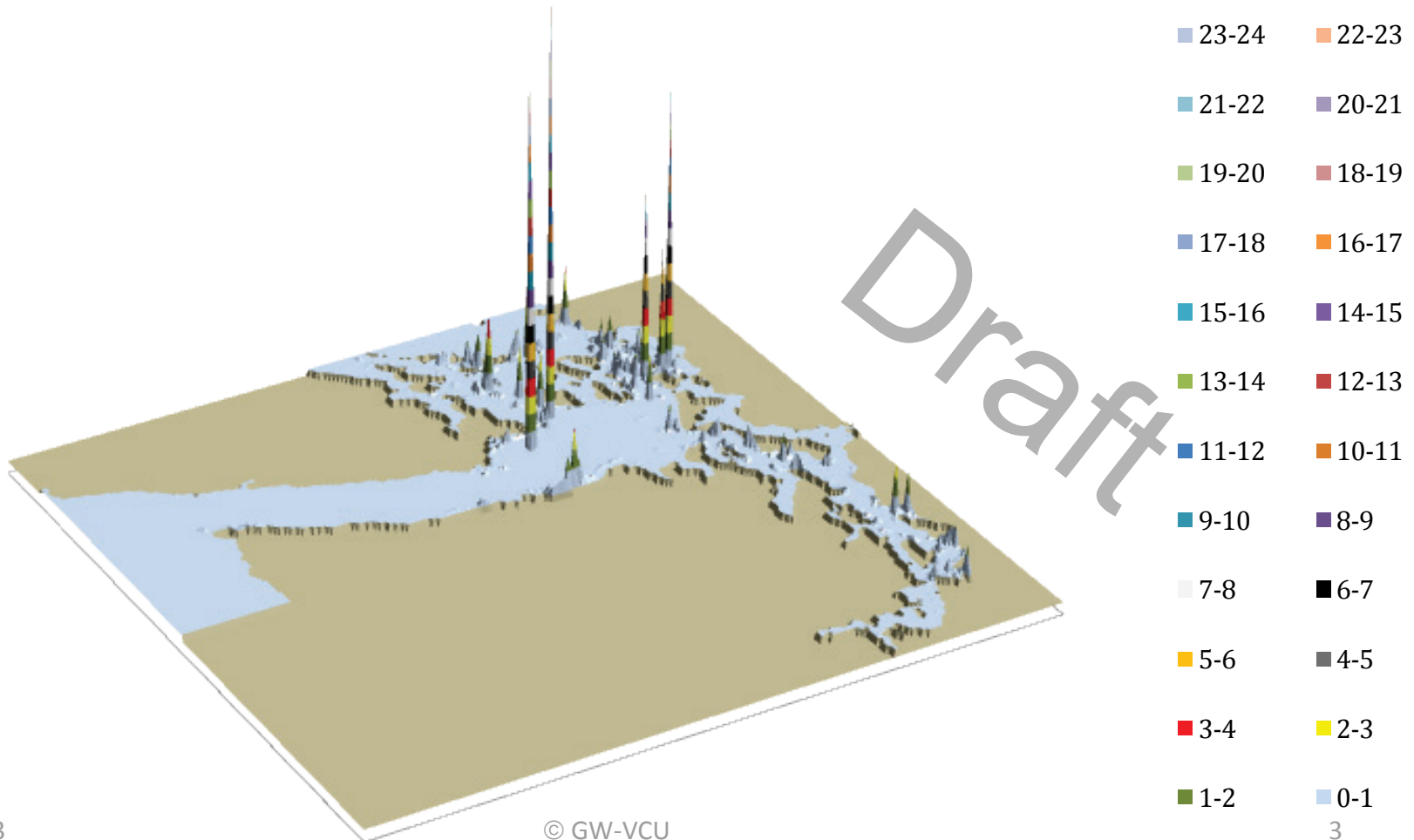


**DEFINITION OF ASSUMED LOCATIONS
FOR ADDED ESCORT VESSEL
FOR HARO-BOUNDARY ROUTES (GREEN)
AND
FOR ROSARIO ROUTES (ORANGE)**

RMM: + 1 Escort for
Laden Tankers, Chem.
Carrier, ATB & Cape Size
Bulkers on Rosario Routes
(Orange)

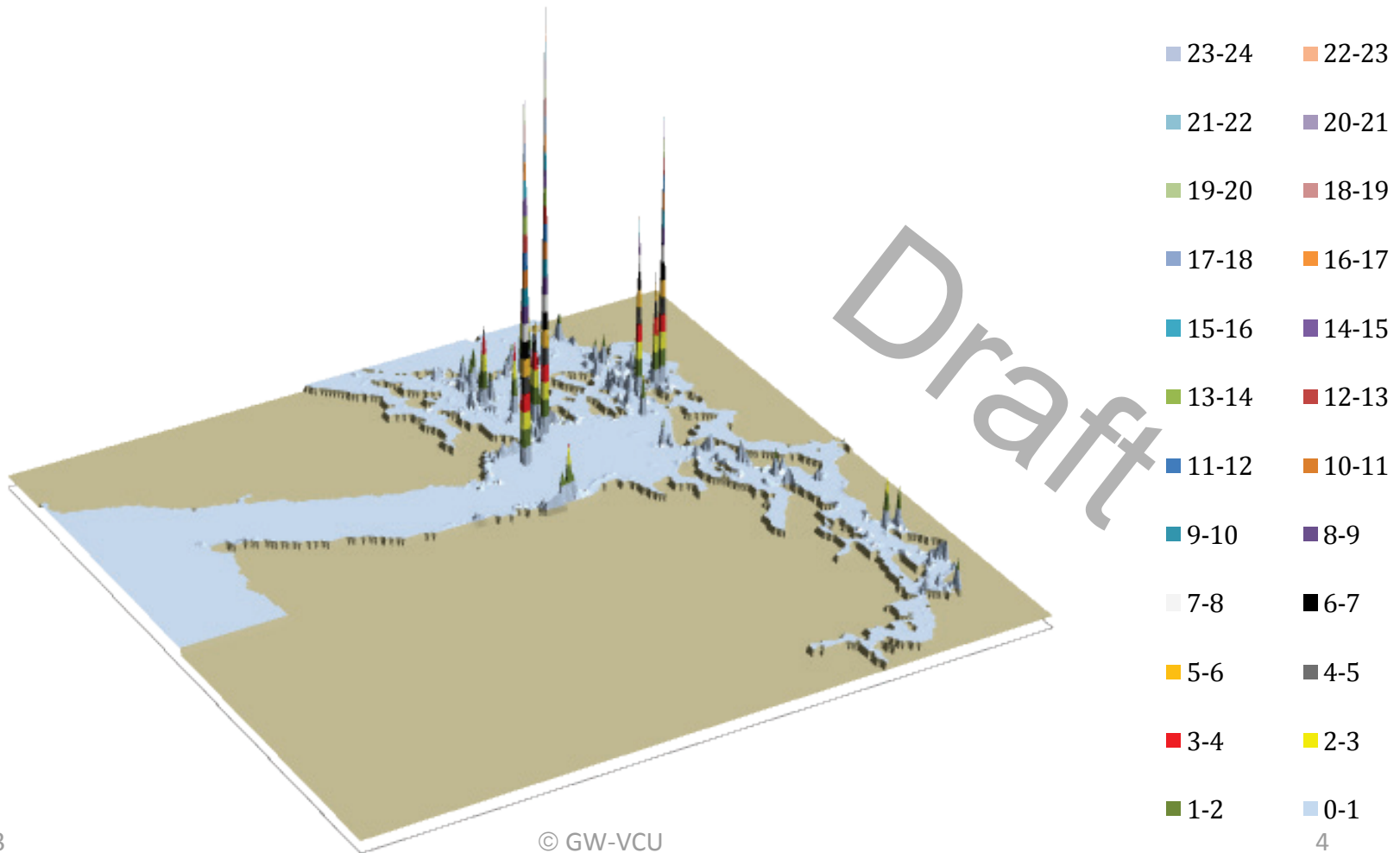
VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

T: GW - KM - DP & EH 3D Risk Profile All FV - Pot. Ground. Oil Loss: 133% of Base Case PGO



VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

T: GW - KM - DP & ER 3D Risk Profile All FV - Pot. Ground. Oil Loss: 153% of Base Case PGO



VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

T: VTRA 2010 - GW - KM - DP & +1 ESCORT HARO-BOUNDARY - ALL FV

132.7%

0.8%

111.5%

79.2%

Factor x Average
Oil Outflow

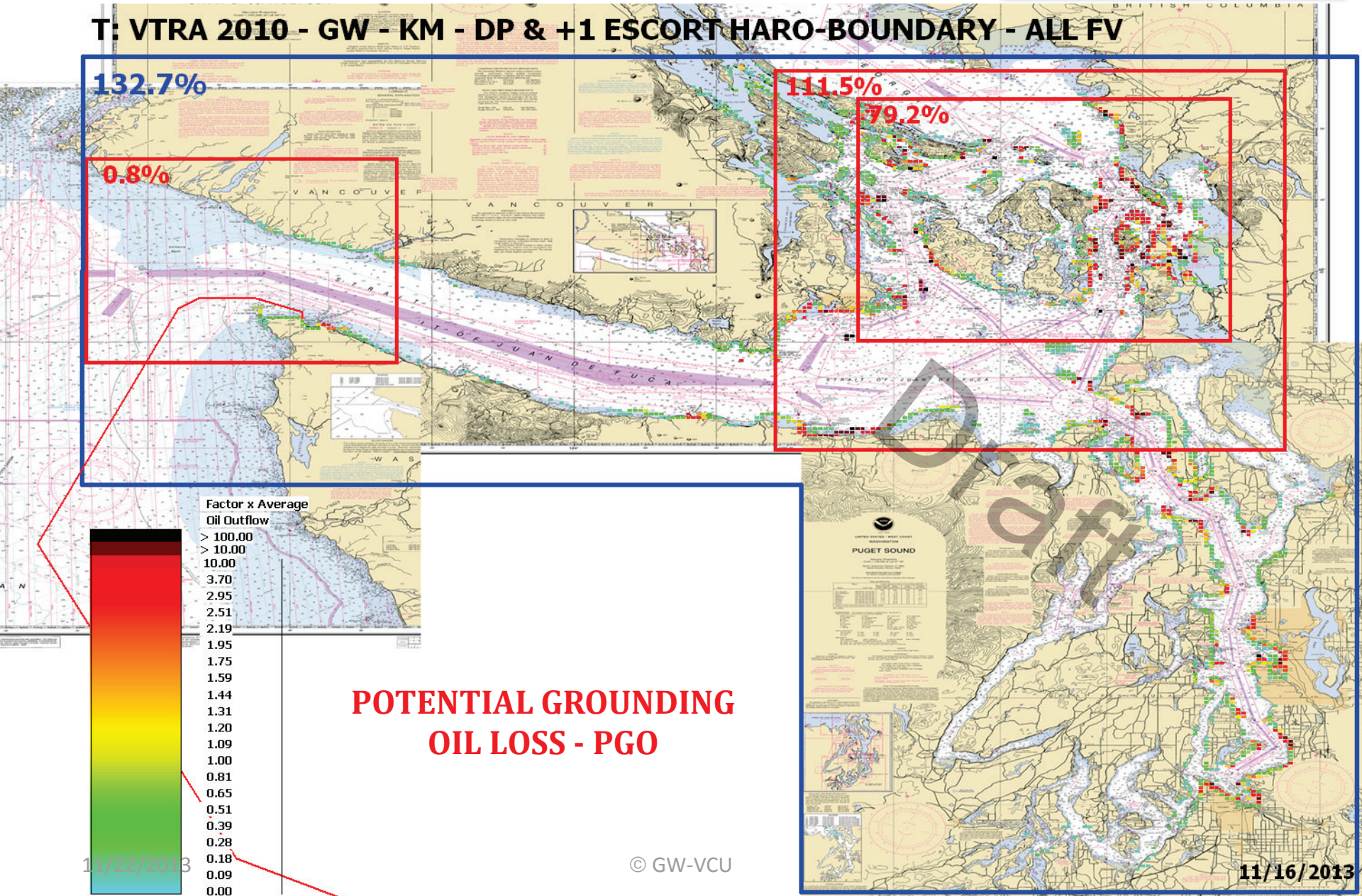
- > 100.00
- > 10.00
- 10.00
- 3.70
- 2.95
- 2.51
- 2.19
- 1.95
- 1.75
- 1.59
- 1.44
- 1.31
- 1.20
- 1.09
- 1.00
- 0.81
- 0.65
- 0.51
- 0.39
- 0.28
- 0.18
- 0.09
- 0.00

POTENTIAL GROUNDING OIL LOSS - PGO

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VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

T: VTRA 2010 - GW - KM - DP & +1 ESCORT ROSARIO - ALL FV

153.3%

0.8%

131.7%

96.3%

Factor x Average
Oil Outflow

- > 100.00
- > 10.00
- 10.00
- 3.70
- 2.95
- 2.51
- 2.19
- 1.95
- 1.75
- 1.59
- 1.44
- 1.31
- 1.20
- 1.09
- 1.00
- 0.81
- 0.65
- 0.51
- 0.39
- 0.28
- 0.18
- 0.09
- 0.00

POTENTIAL GROUNDING OIL LOSS - PGO

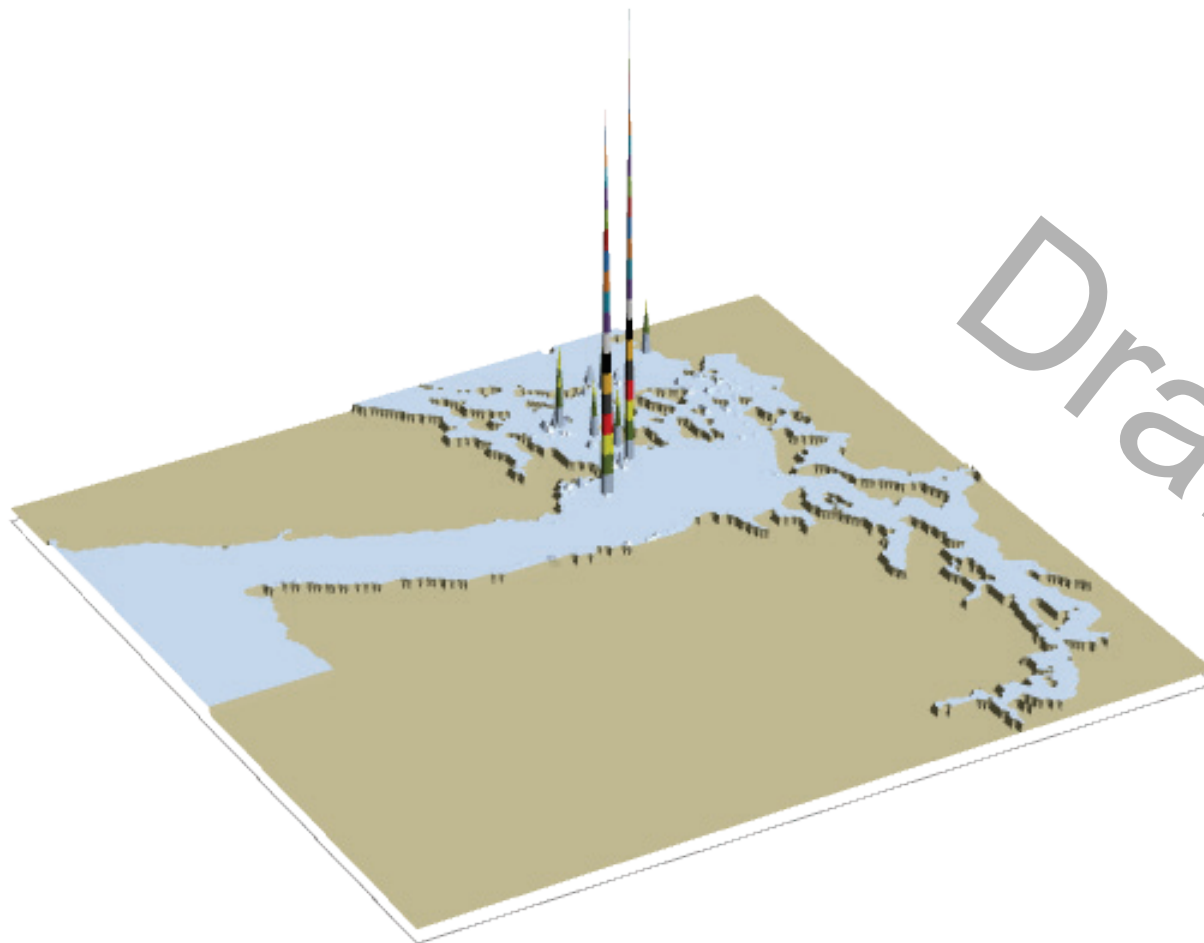
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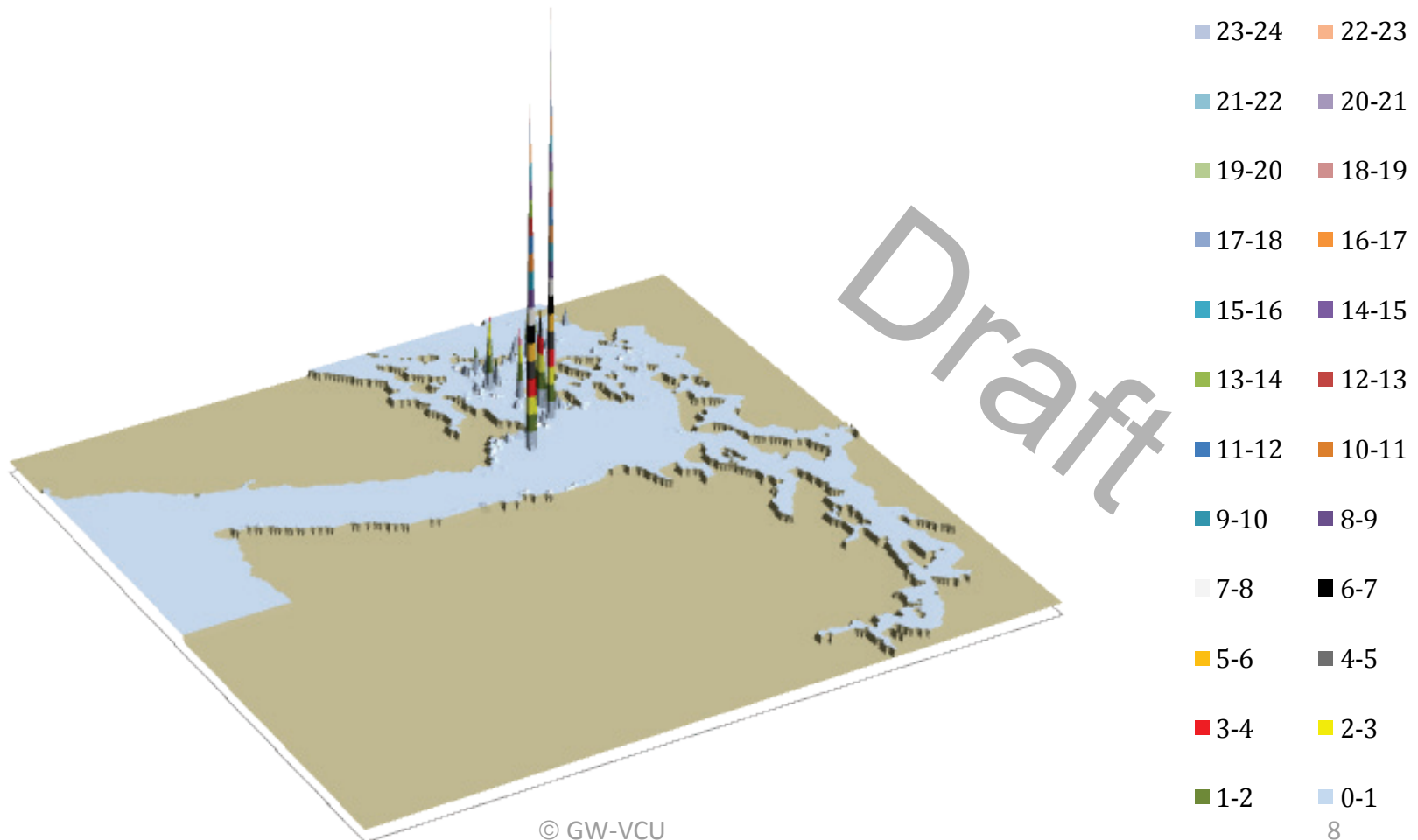
VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

T: GW - KM - DP & EH 3D Risk Profile What-If FV - Pot. Grou. Oil Loss: 40% of Base Case PGO



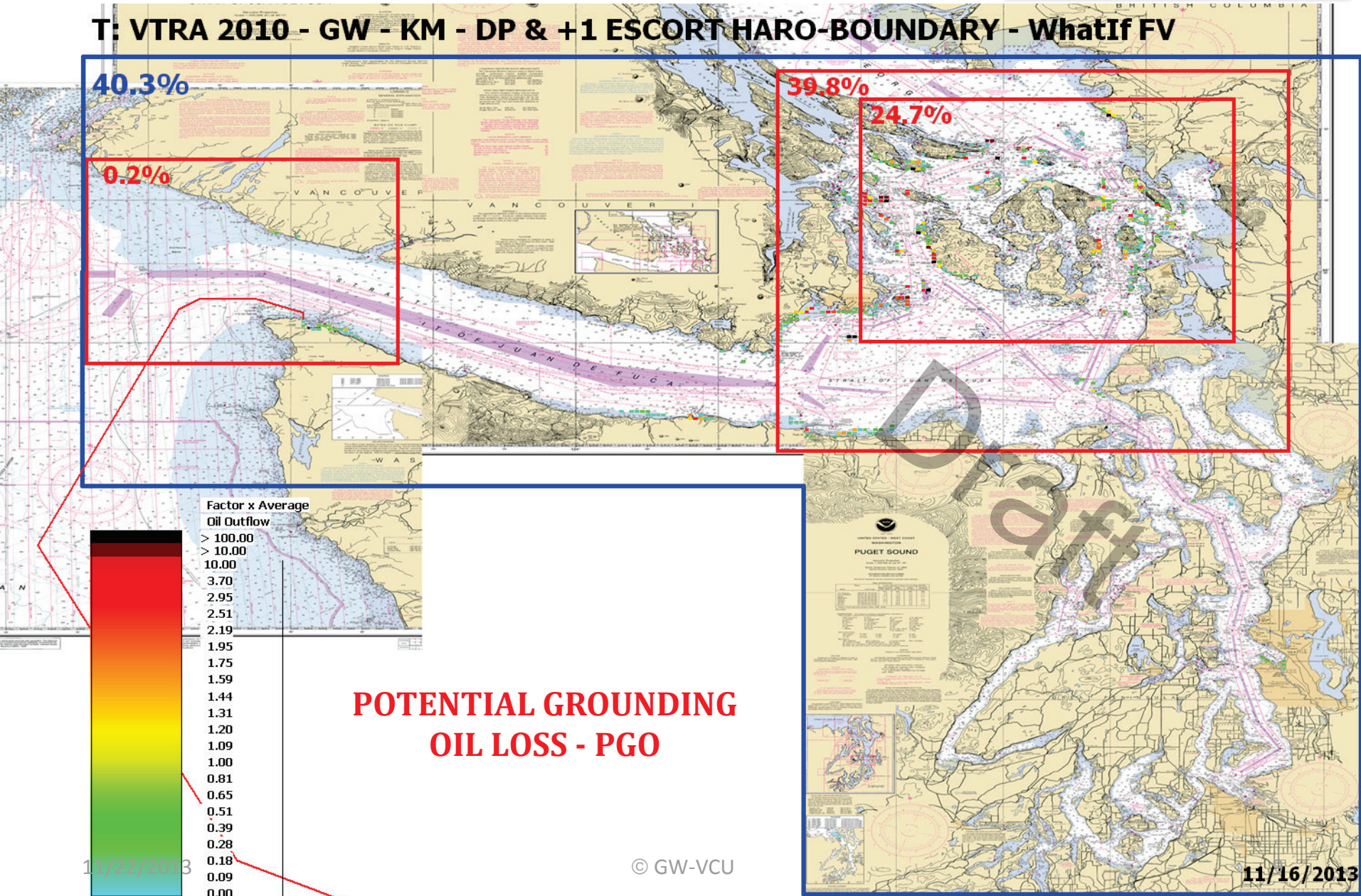
VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

T: GW - KM - DP & ER 3D Risk Profile What-If FV - Pot. Grou. Oil Loss: 60% of Base Case PGO



VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

T: VTRA 2010 - GW - KM - DP & +1 ESCORT HARO-BOUNDARY - WhatIf FV



POTENTIAL GROUNDING OIL LOSS - PGO

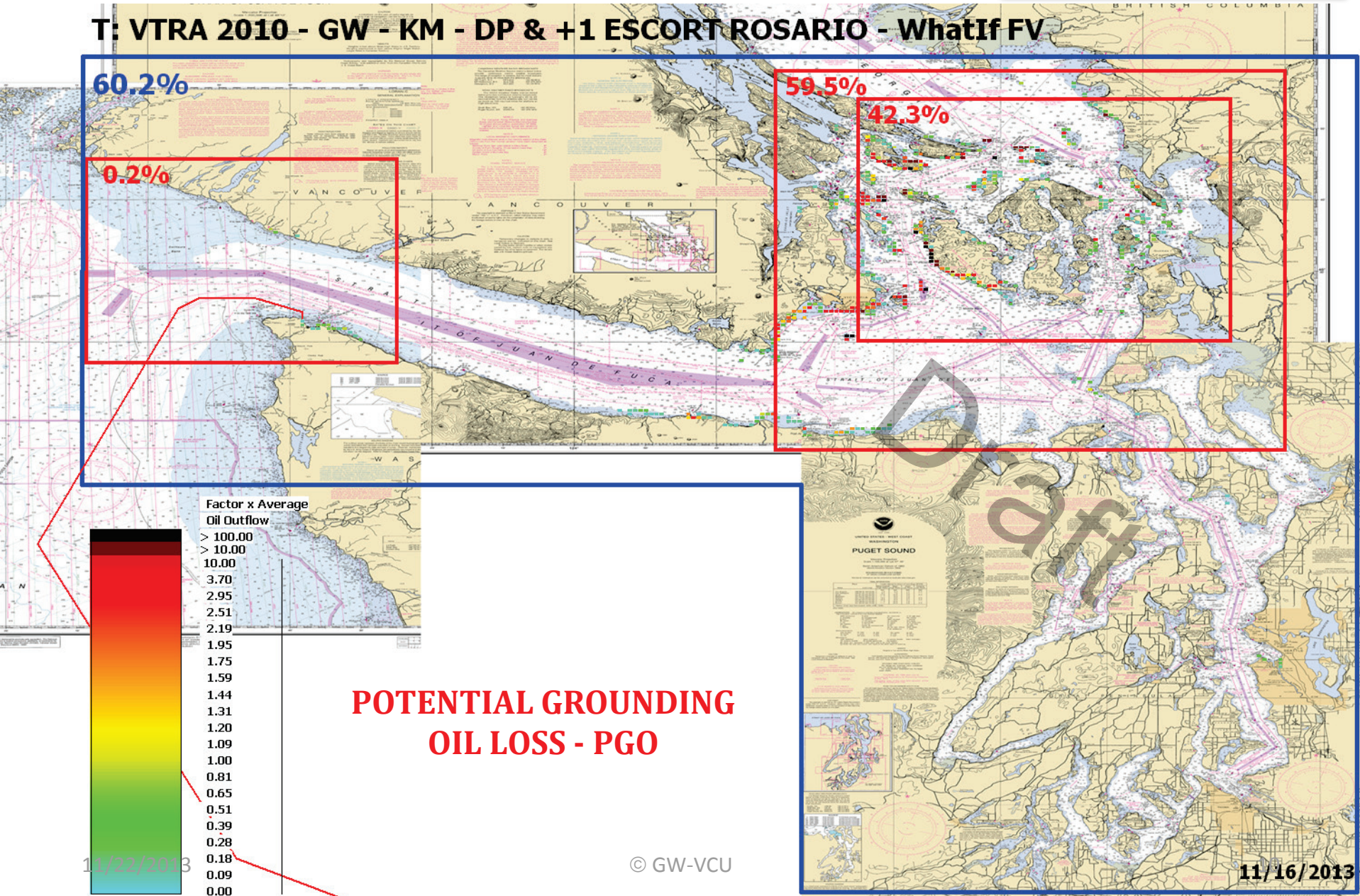
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VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

T: VTRA 2010 - GW - KM - DP & +1 ESCORT ROSARIO - WhatIf FV



POTENTIAL GROUNDING OIL LOSS - PGO

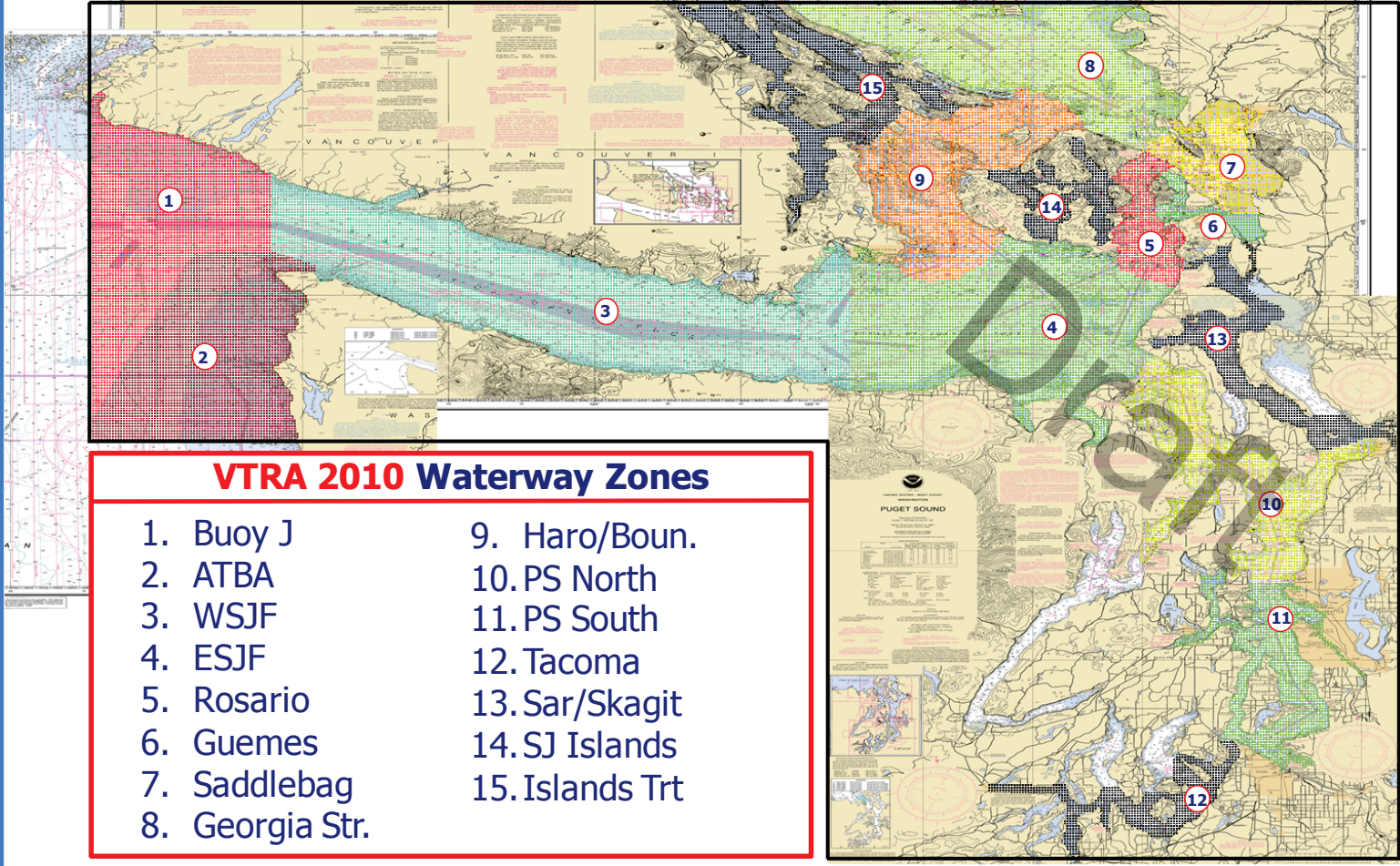
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VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

DEFINITION OF 15 WATERWAY ZONES



VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

% Base Case Grounding Oil Loss - ALL_FV

Waterway Zone:

Haro/Boun. : +19.7% | x 1.67

ESJF: +2.2% | x 1.09

Saddlebag: -1.9% | x 0.89

Rosario : -2.0% | x 0.84

Guemes : -0.9% | x 0.92

PS South : +0.1% | x 1.01

PS North : 0.0% | x 1.00

Georgia Str. : -0.6% | x 0.90

Islands Trt : +2.5% | x 1.48

WSJF: +1.2% | x 1.27

Tac. South : 0.0% | x 1.00

ATBA : 0.0% | x 0.99

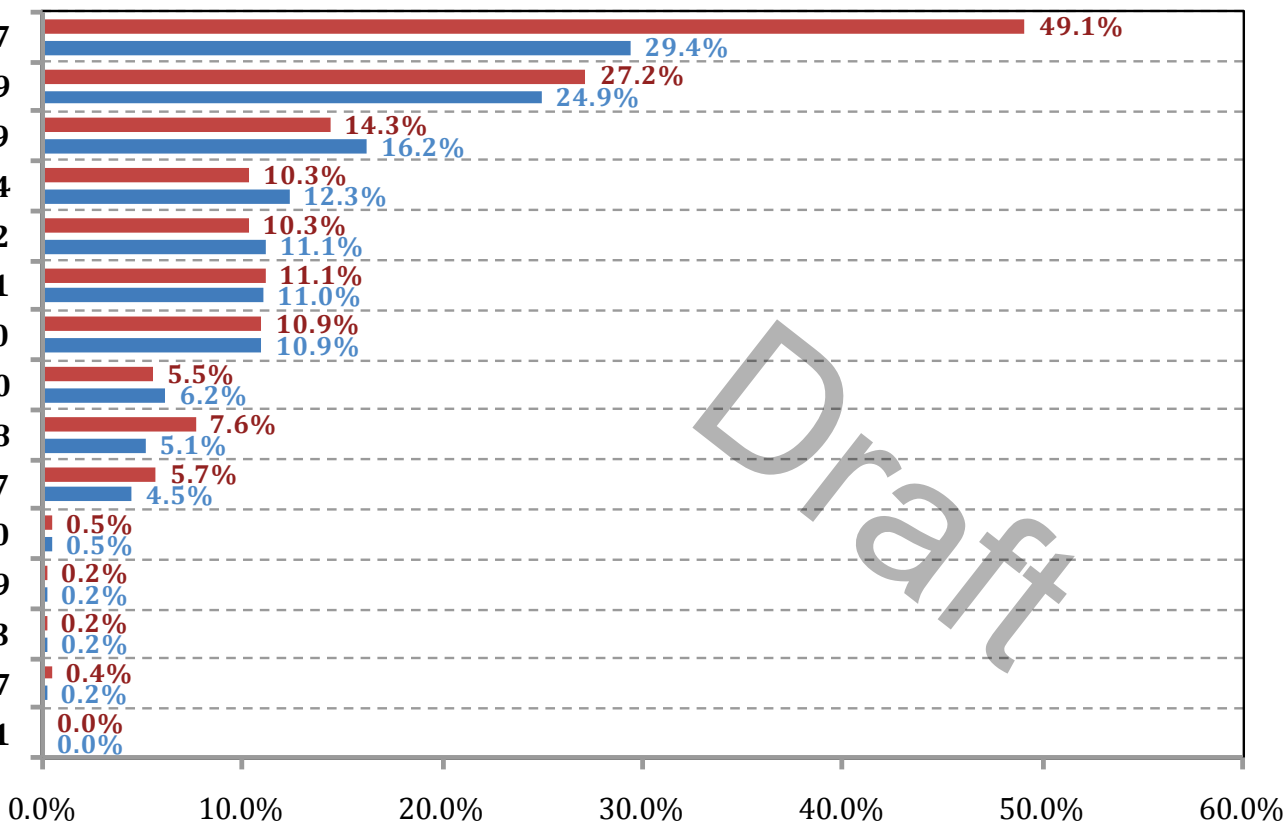
Sar/Skagit : 0.0% | x 0.93

SJ Islands : +0.2% | x 2.27

Buoy J : +0.0% | x 1.01

+

-27%



% Base Case Grounding Oil Loss (GOL) - ALL_FV

■ T:GW - KM - DP & ER : 153% (+21% | x 1.16) ■ T:GW - KM - DP & EH : 133%

VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

% Base Case Grounding Oil Loss - WhatIf

Waterway Zone:

Haro/Boun. : +16.0% | x 1.74

ESJF : +1.7% | x 1.12

Saddlebag : -0.2% | x 0.59

Rosario : -0.4% | x 0.46

Guemes : 0.0% | x 0.81

PS South : +0.0% | x 1.00

PS North : 0.0% | x 1.00

Georgia Str. : -0.2% | x 0.87

Islands Trt : +2.1% | x 16.12

WSJF : +0.7% | x 1.79

Tac. South : +0.0%

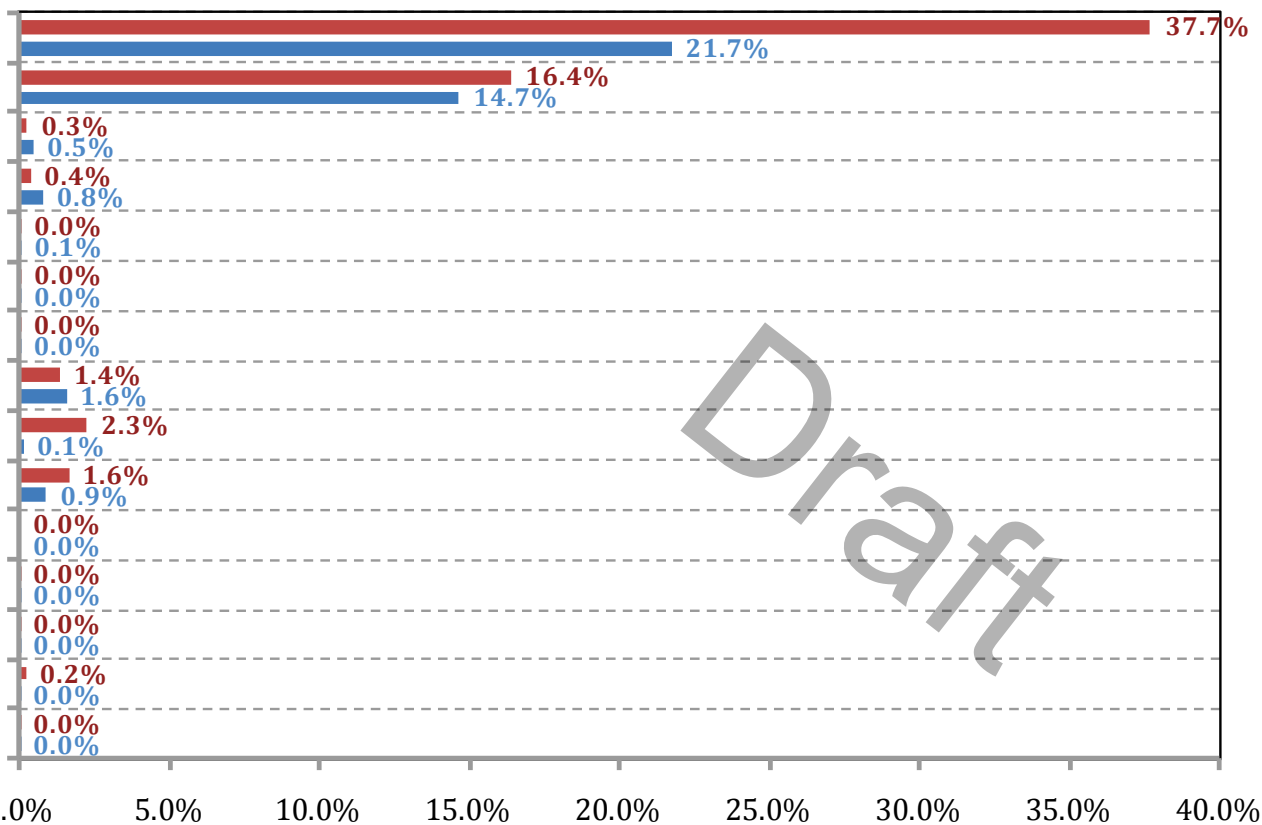
ATBA : +0.0% | x 1.00

Sar/Skagit : 0.0% | x 0.93

SJIslands : +0.2% | x 43.79

Buoy J : +0.0% | x 1.04

+ **+20%**



% Base Case Grounding Oil Loss (GOL) - WhatIf

■ T:GW - KM - DP & ER : 60% (+20% | x 1.49) ■ T:GW - KM - DP & EH : 40%