

LEVANTAMIENTOS GEOLÓGICOS PARA EL TERCER JUEGO DE ESCLUSAS

PRESENTACION: Derek Irving

LEVANTAMIENTO GEOLÓGICOS: Unidad de Geología.

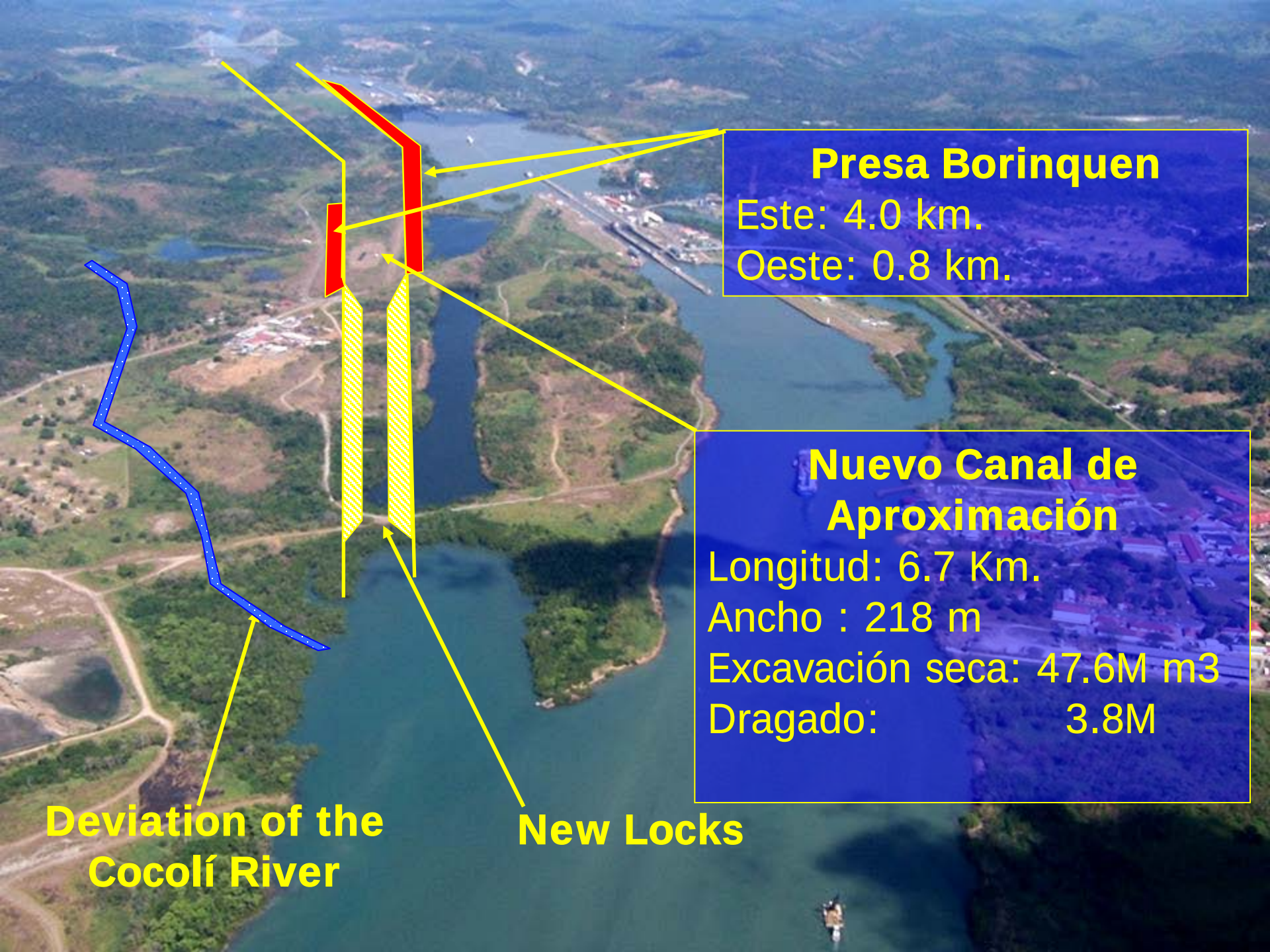
Sección de Geotécnia – Departamento de Ingeniería y Proyectos

Autoridad del Canal de Panamá

13 de Septiembre , 2016



CANAL DE PANAMÁ



Presa Borinquen

Este: 4.0 km.

Oeste: 0.8 km.

Nuevo Canal de Aproximación

Longitud: 6.7 Km.

Ancho : 218 m

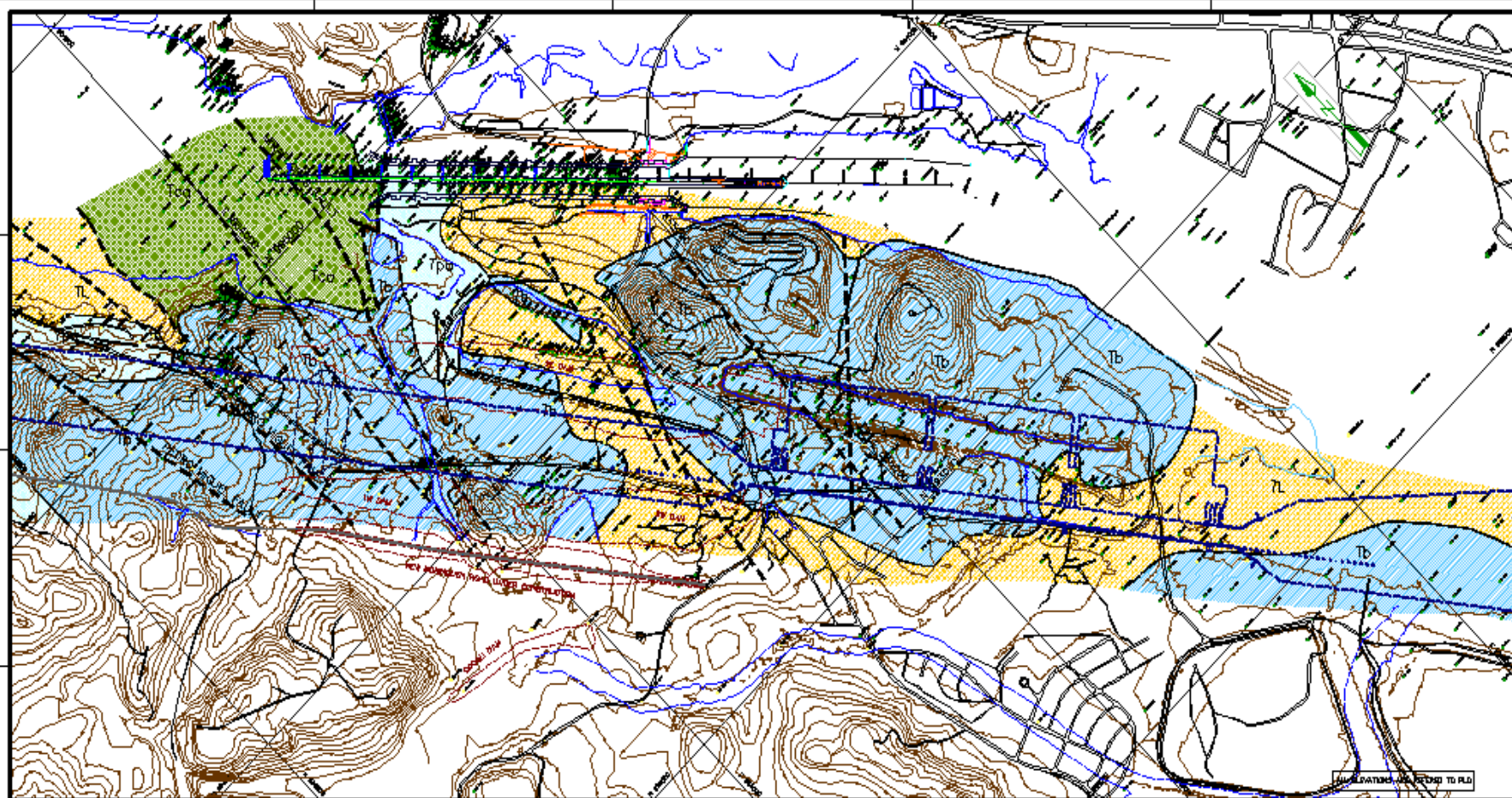
Excavación seca: 47.6M m³

Dragado: 3.8M

**Deviation of the
Cocolí River**

New Locks

MAPA GEOLÓGICO PACÍFICO



PLAN VIEW
SCALE 1:10000

LEGEND

- QU-1234 100% SLOPE
- 7000-1200 80% SLOPE

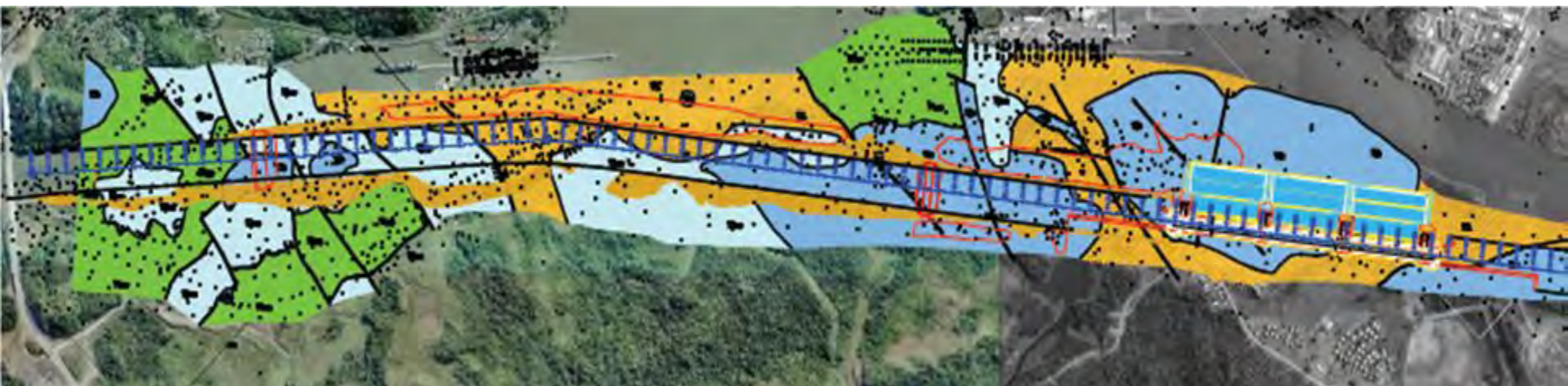
SYMBOLY

- Tb BASALT
Basalt, of Upper Miocene, in intrusive and extrusive.
- Tp PEGMATITE
Pegmatite, of Upper Miocene, in intrusive and extrusive. Pegmatite is a type of igneous rock that is composed of large crystals of various minerals, including quartz, feldspar, and mica. It is typically found in the cores of igneous intrusions.
- La LAGUNA
La Laguna, of Upper Miocene, is a type of igneous rock that is composed of large crystals of various minerals, including quartz, feldspar, and mica. It is typically found in the cores of igneous intrusions.
- OLIVINA
Olivine, of Upper Miocene, is a type of igneous rock that is composed of large crystals of various minerals, including quartz, feldspar, and mica. It is typically found in the cores of igneous intrusions.

FORMATION

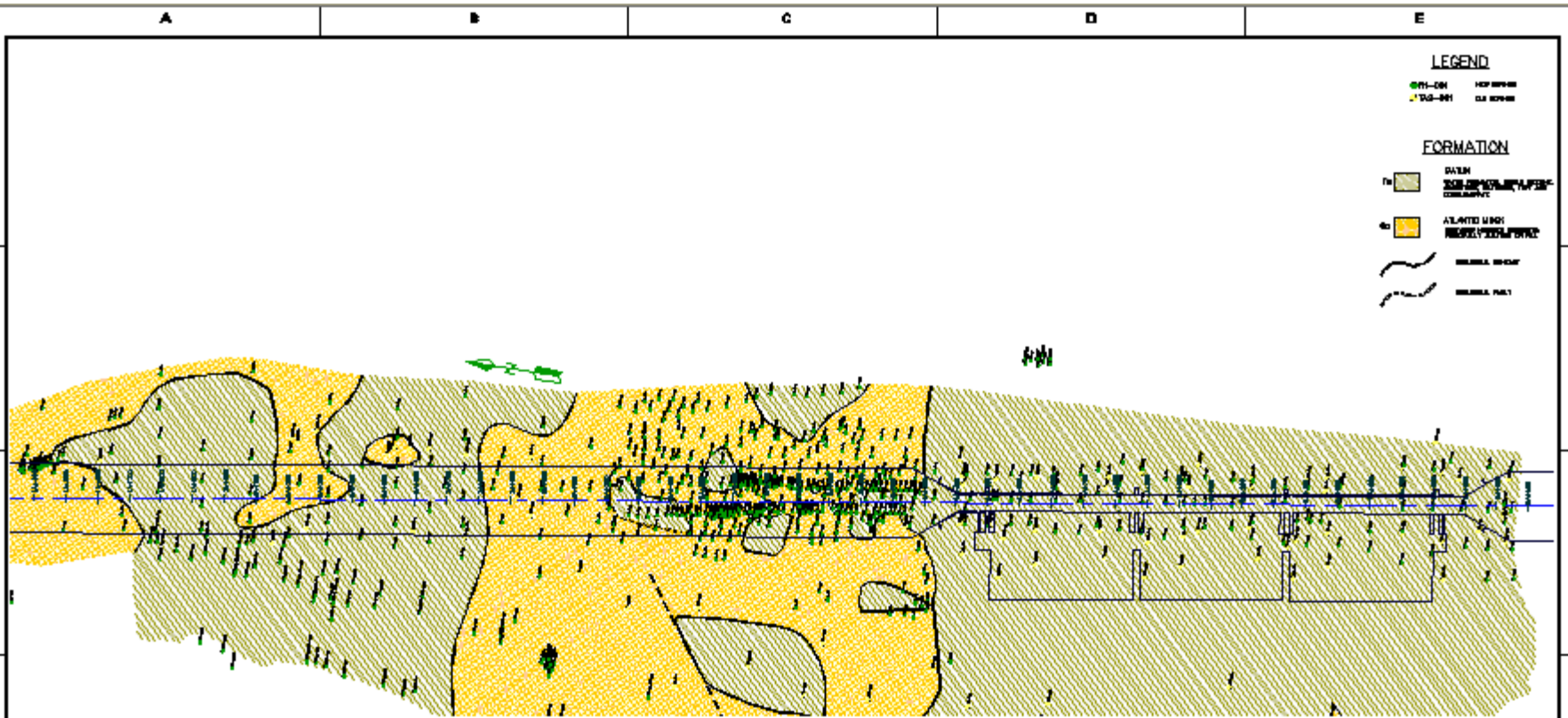
GENERAL REGION	DEPARTMENT OF CHIRIQUÍ	DEPARTMENT OF PANAMA
CHIRIQUÍ	CHIRIQUÍ	CHIRIQUÍ
PANAMA	PANAMA	PANAMA
PROVINCE OF CHIRIQUÍ	PROVINCE OF CHIRIQUÍ	PROVINCE OF CHIRIQUÍ
PROVINCE OF PANAMA	PROVINCE OF PANAMA	PROVINCE OF PANAMA

Perforaciones – Esclusas Pacífico



Año	ID. de los Hoyos	Ubicación	Total	Long. (m)
1938-1948	PM	Pedro Miguel	504	18,748
	M	Miraflores	495	12,855
2001	TP1 / 2	Miraflores	68	3,009
2005-2007	NML / PAC / URS	Pedro Miguel- Miraflores	266	10,865
TOTAL			1,332	45,477

MAPA GEOLÓGICO ATLÁNTICO



PLAN VIEW
SCALE THREE

ALL ELEVATIONS ARE REFERRED TO MLLW

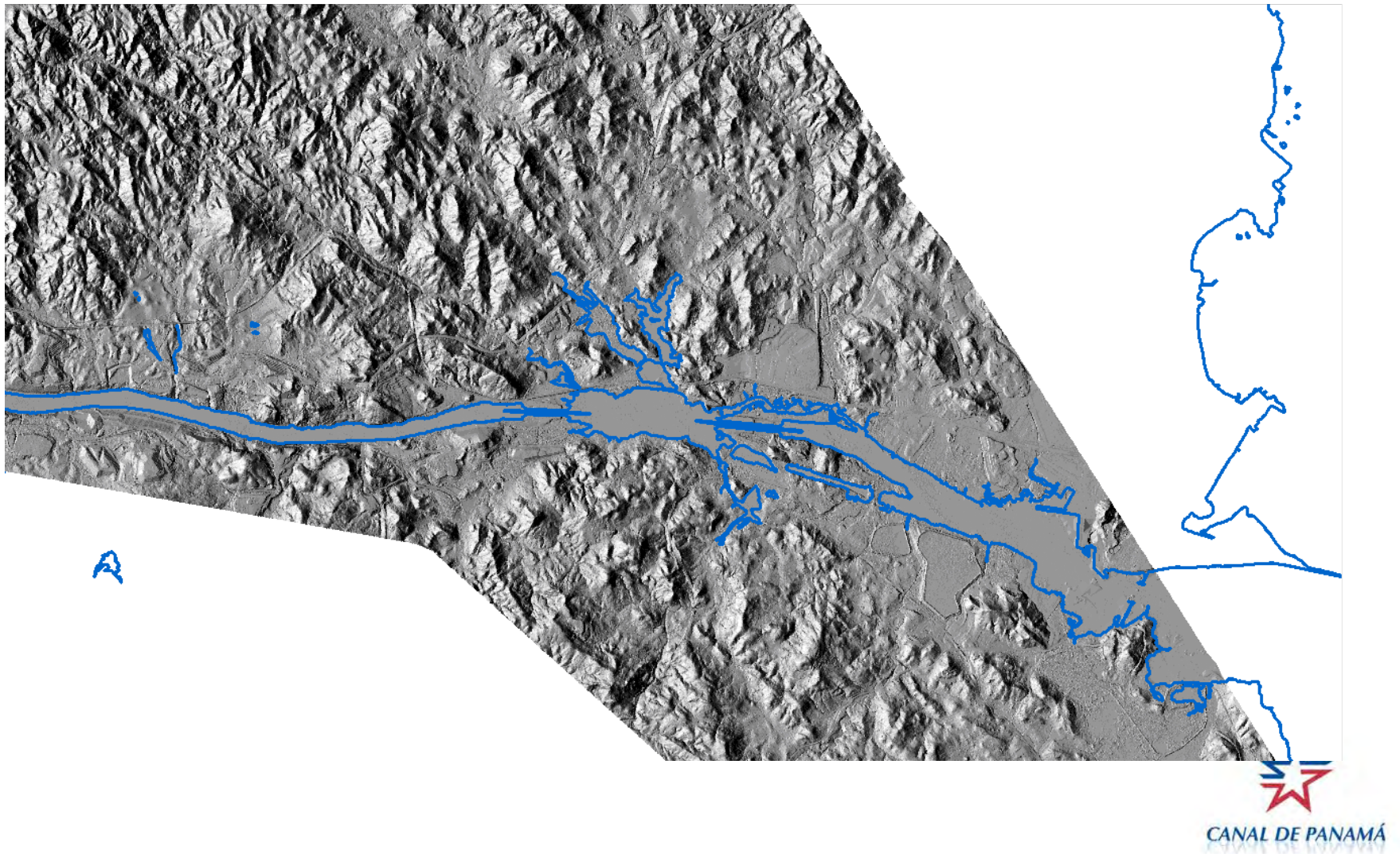
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 83	
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PERFORACIONES – ESCLASAS ATLÁNTICO

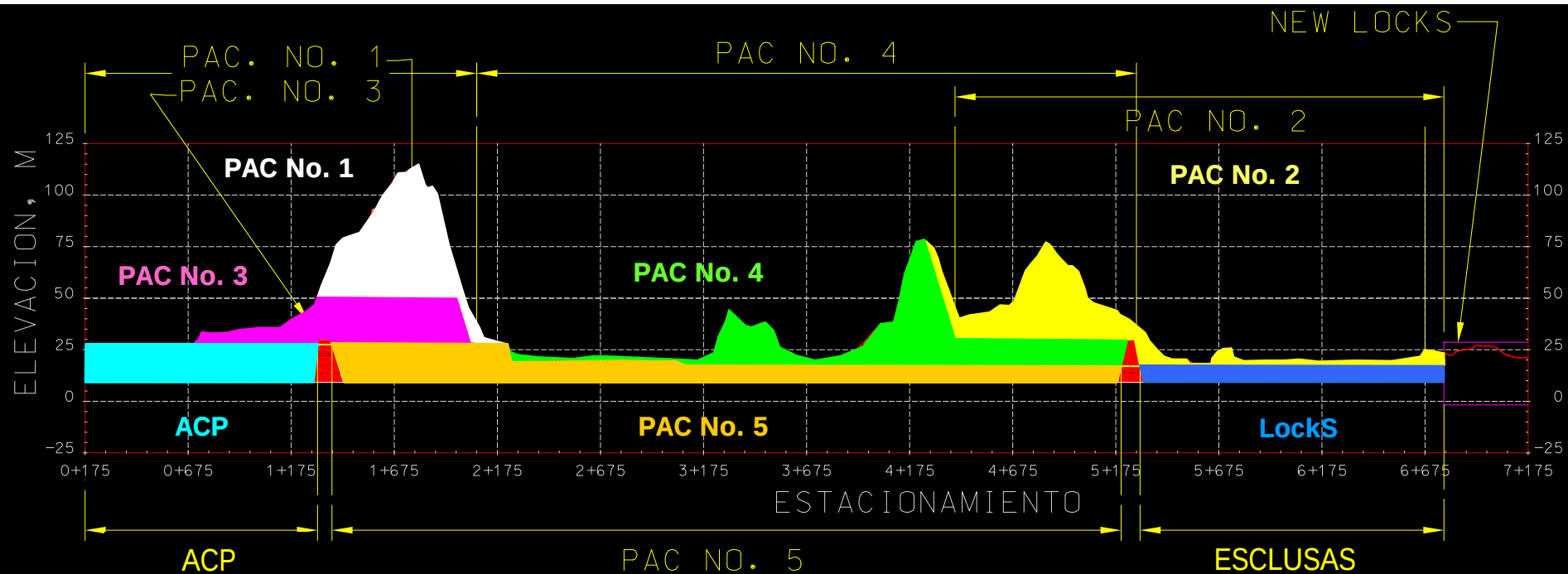


Year	ID. Of the Borings	Location	Total	Long. (m)
1938-1948	G	Gatun	570	12,938
2001	TA1/2	Gatun	43	1,861
2005-2007	NGL	Gatun	55	3,623
TOTAL			668	18,422

MODELO LIDAR PACÍFICO



Sequence of the Excavations



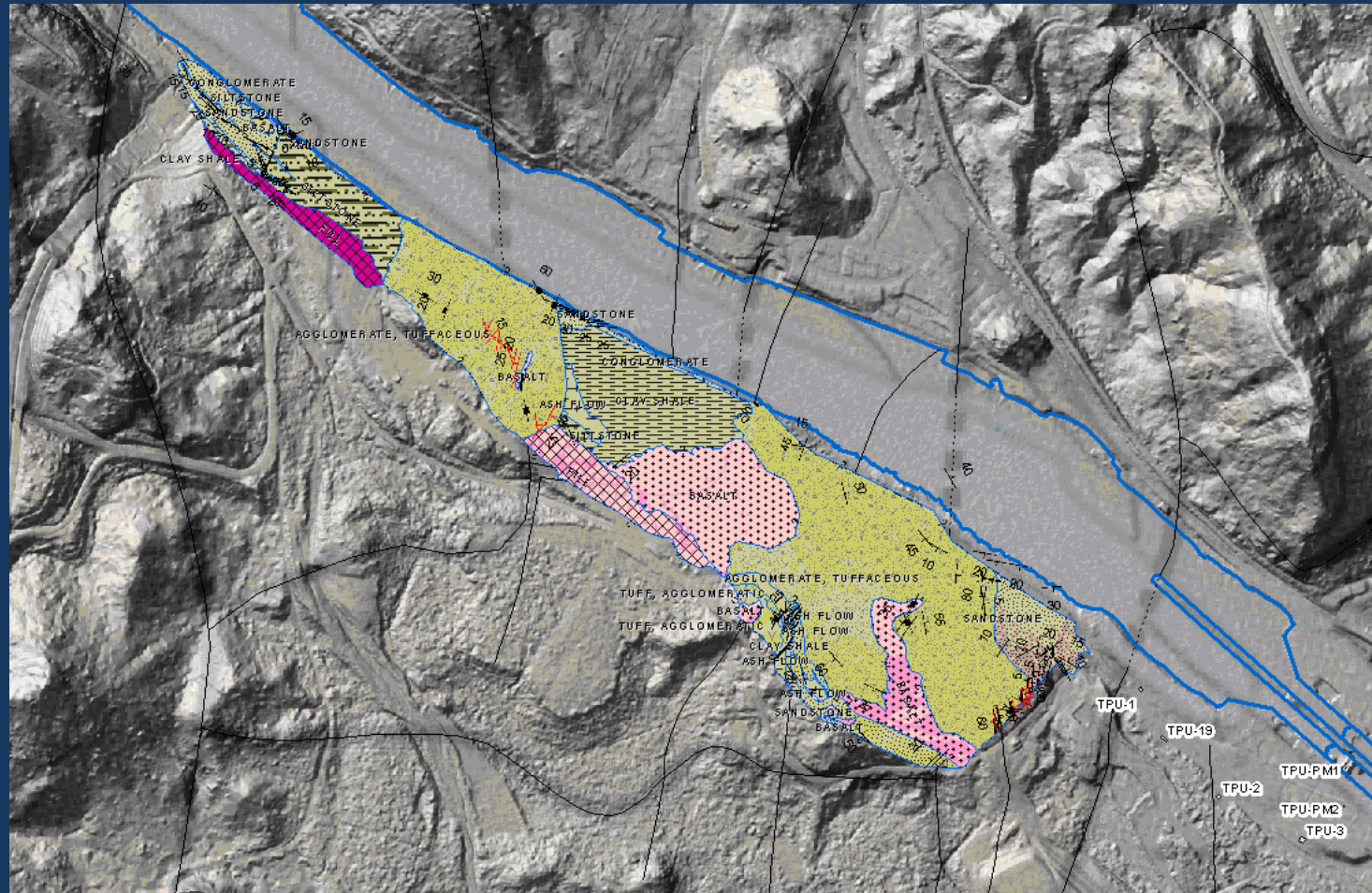
VENTAJAS DEL MAPEO GEOLÓGICO DIGITAL



- El mapeo puede ser realizado con mayor velocidad y con menos personal.
- Disminuyen las fuentes potenciales de errores.
- Toda la información geológica tomada en campo queda automáticamente almacenada en la base de datos.
- La información de campo puede ser correlacionada de inmediato con la información pre-existente.

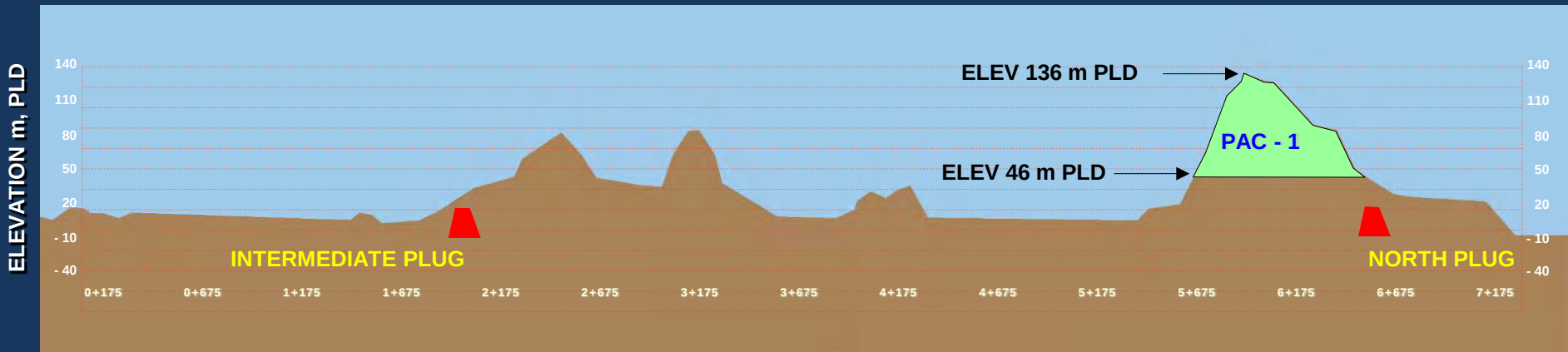


Example of Geologic Map of PAC-3 obtained with ArcPad and placed on a Lidar Image

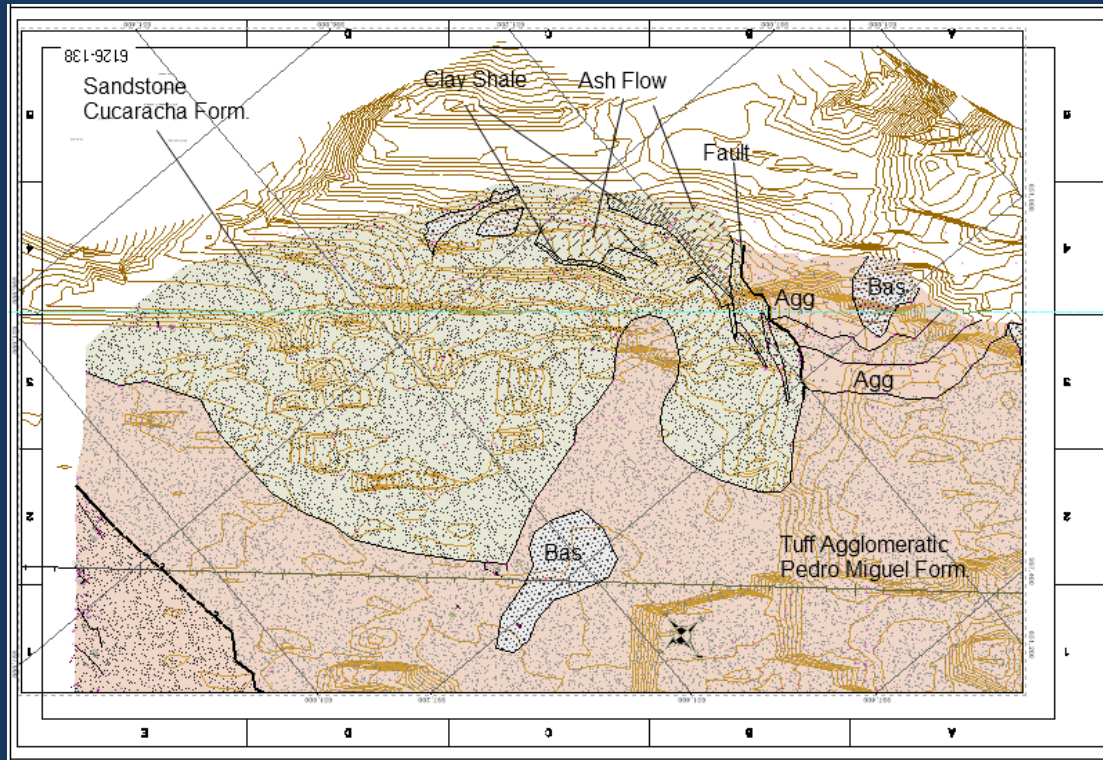


Pacific Access Channel #1 – PAC 1

Excavation of 7.4 Mm³ between stations 1P+250 and 2P+280, located northwest of Pedro Miguel .



GEOLOGIC MAP PAC-1 (1P+250 and 2P+280),



PROJECT: PAC-1
 SITE: BASE OF CARTAGENA HILL
 FORMATION: CUCARACHA
 ROCK TYPE: ASH FLOW / SILTSTONE SANDY
 STRUCTURE: LITHOLOGIC CONTACT
 NAD27 COORD: N997 545; E851 190
 OBJECT ID: 185
 DATE: 2 OCT. 2009
 GEOLOGISTS: DEREK IRVING, ROBERTO MIRANDA



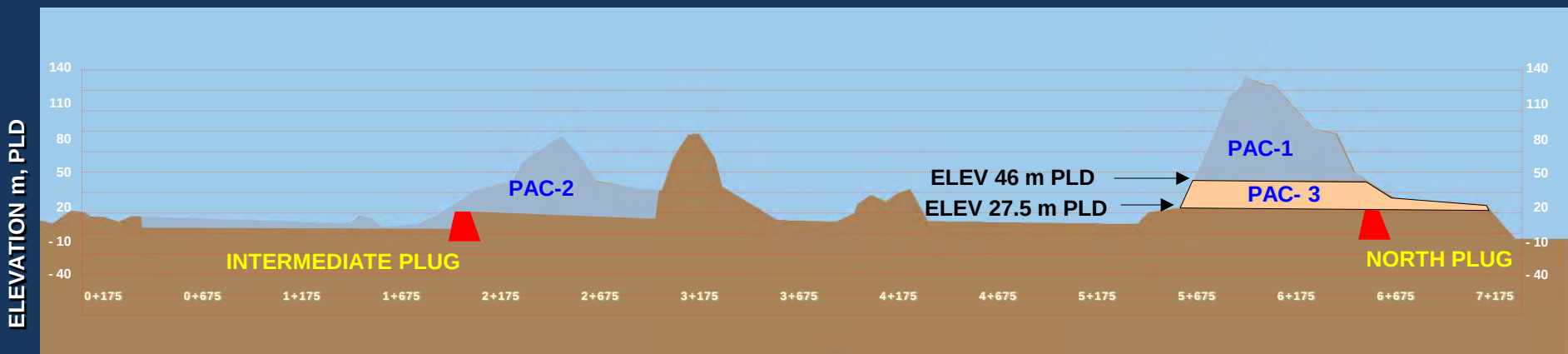
PROJECT: PAC-1
 SITE: BASE OF CARTAGENA HILL
 FORMATION: CUCARACHA PEDRO MIGUEL
 STRUCTURE: FAULT CONTACT
 STRIKE AND DIP OF FAULT: N30E, VERTICAL
 NAD27 COORD: N997 577; E851 177
 OBJECT ID: 184
 DATE: OCT 2, 2009
 GEOLOGISTS: D. IRVING, R. MIRANDA

PROJECT: PAC-1
 SITE: BASE OF CARTAGENA HILL
 FORMATION: CUCARACHA PEDRO MIGUEL
 ROCK TYPE: ASH FLOW, SILTSTONE SANDY, TUFF AGG.
 STRUCTURE: FAULT AND CONTACT
 STRIKE AND DIP OF FAULT: N30E, VERTICAL
 NAD27 COORD: N997 518; E851 178
 DATE: OCT 2, 2009
 OBJECT ID: 185
 GEOLOGISTS: D. IRVING, R. MIRANDA



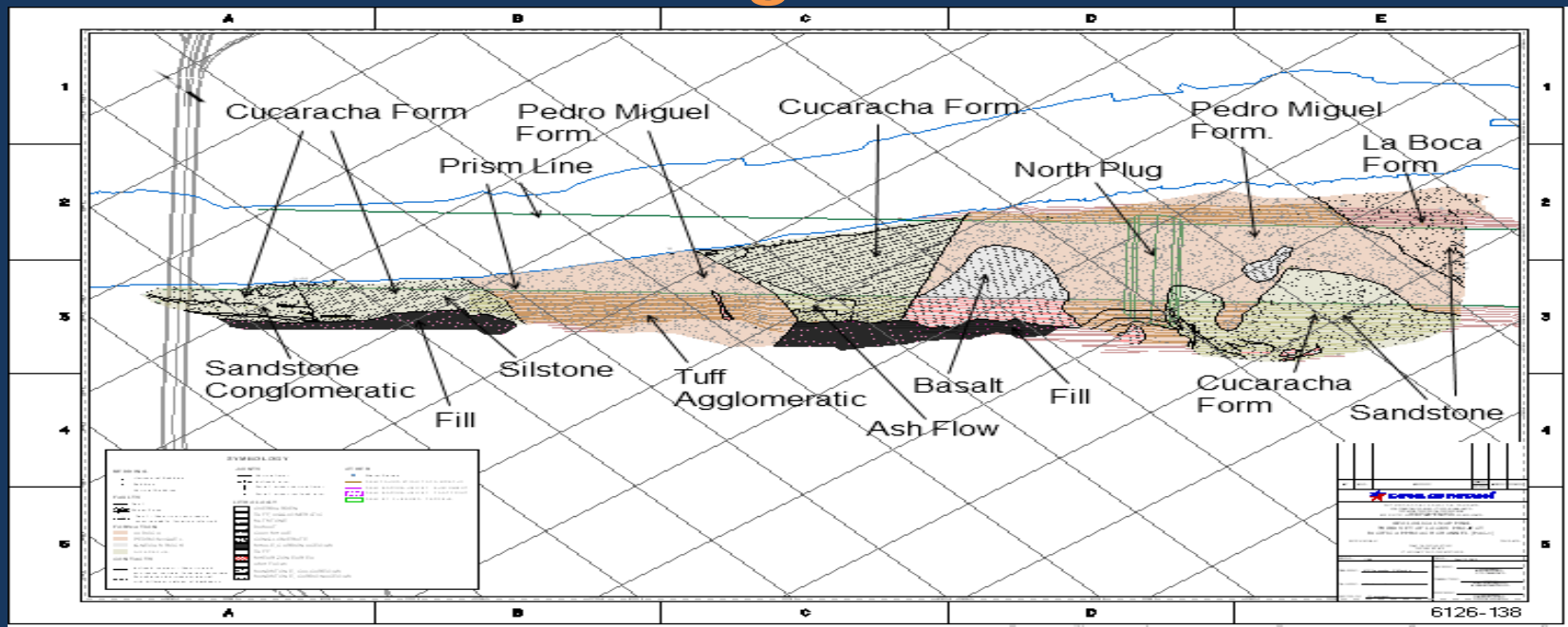
Pacific Access Channel #3 – PAC 3

Excavation of 8.0 Mm³ between stations 0P+950 and 2P+300, located north and beneath of PAC-1 excavation,



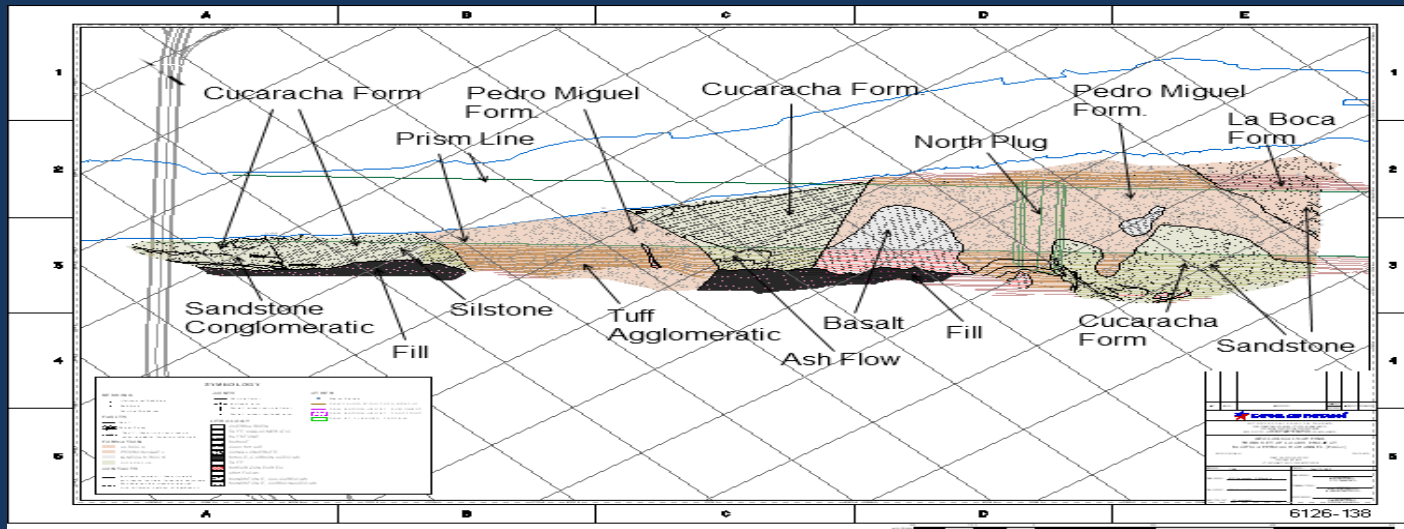
Geologic Map PAC-3 (0P+950 and 2P+300)

Cucaracha Fm. Conglomeratic Sandstone



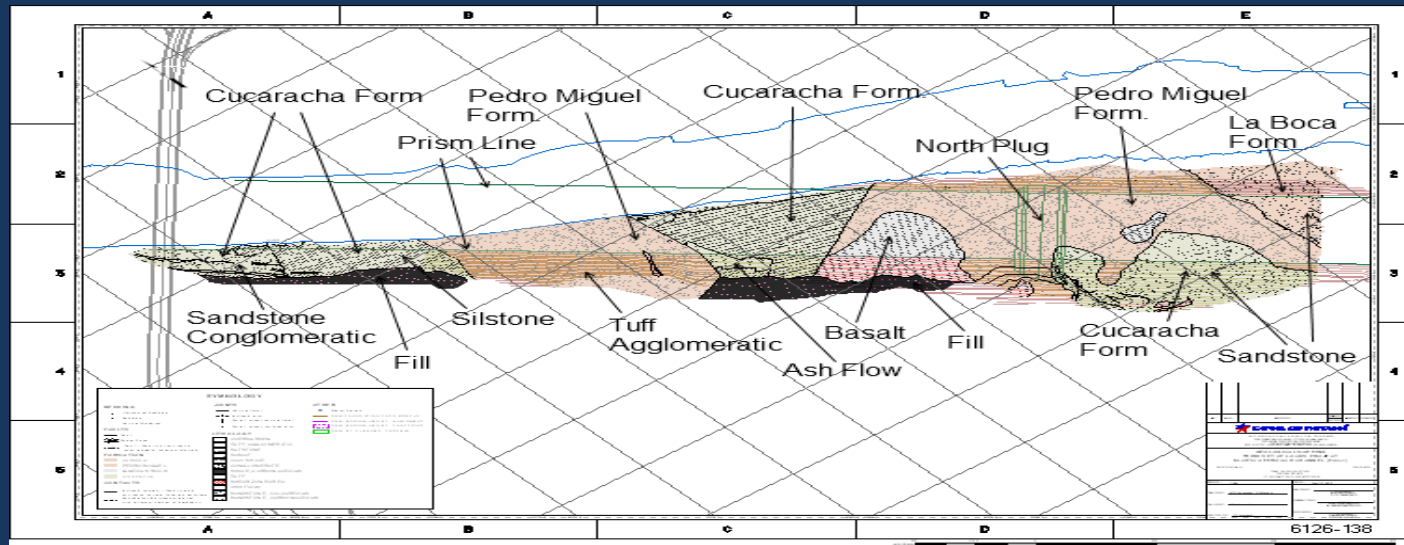
Geologic Map PAC-3 (0P+950 and 2P+300)

La Boca Fm. Sandstone Fossiliferous

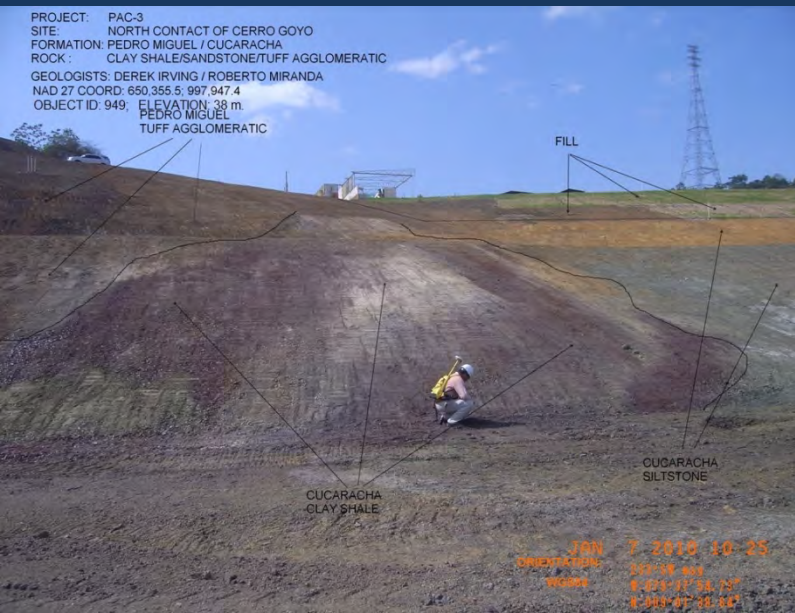


Geologic Map PAC-3 (0P+950 and 2P+300)

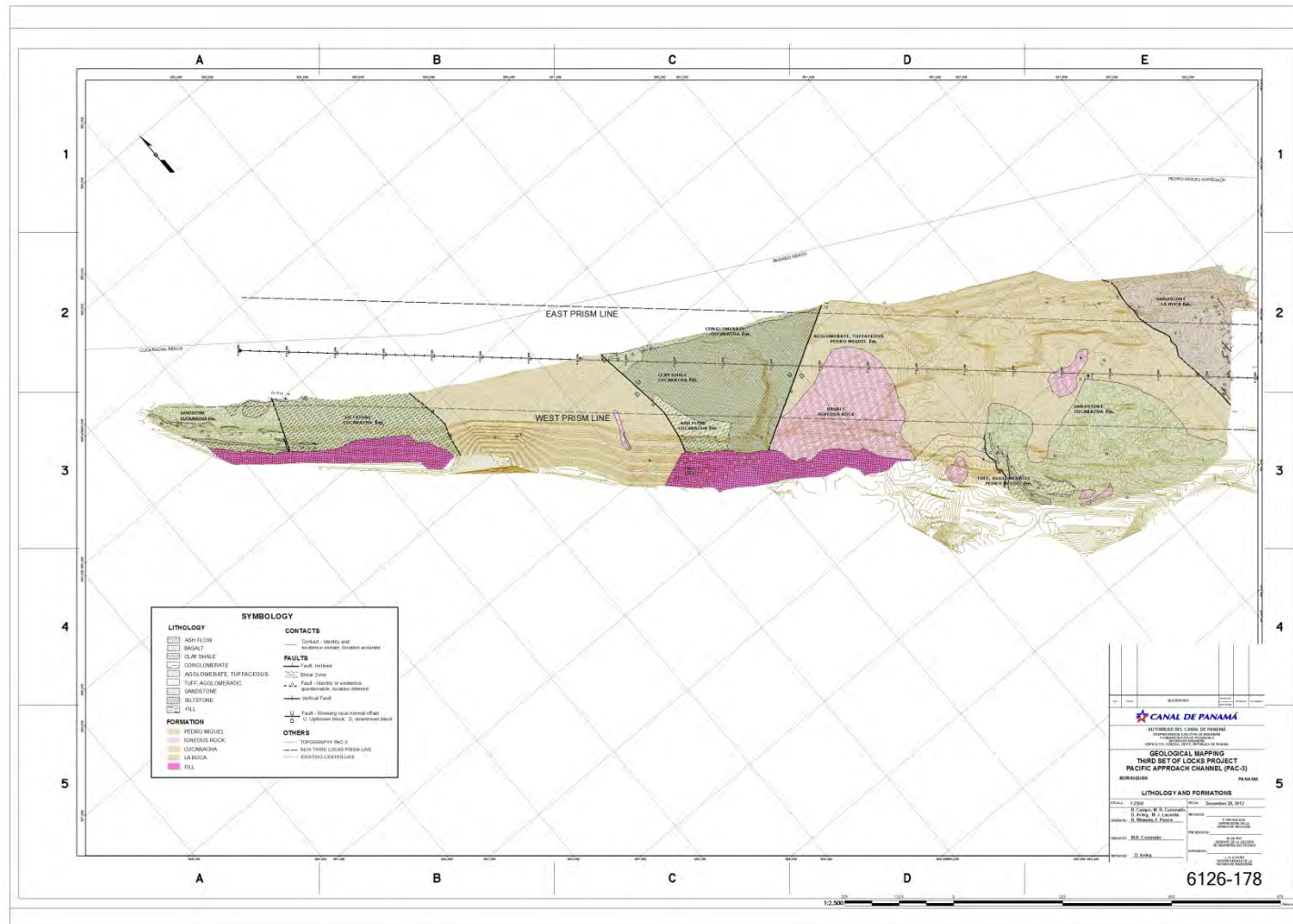
CONTACT - PEDRO MIGUEL Fm. / CUCARACHA Fm.



PROJECT: PAC-3
 SITE: NORTH CONTACT OF CERRO GOYO
 FORMATION: PEDRO MIGUEL / CUCARACHA
 ROCK: CLAY SHALE/SANDSTONE/TUFF AGGLOMERATIC
 GEOLOGISTS: DEREK IRVING / ROBERTO MIRANDA
 NAD 27 COORD: 650,355.5; 997,947.4
 OBJECT ID: 949; ELEVATION: 38 m.
 PEDRO MIGUEL
 TUFF AGGLOMERATIC

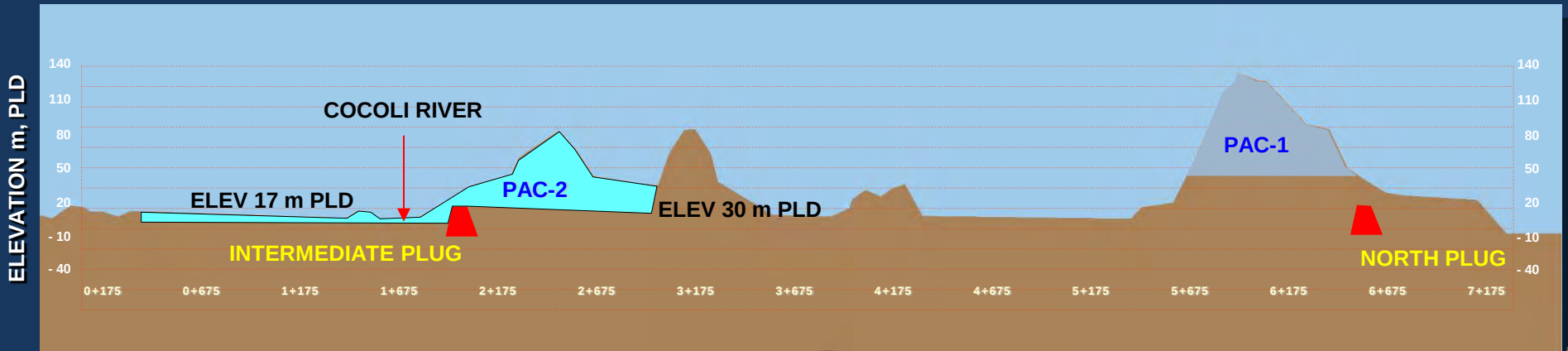


FINAL EDITED GEOLOGIC MAP PAC-1 AND PAC-3



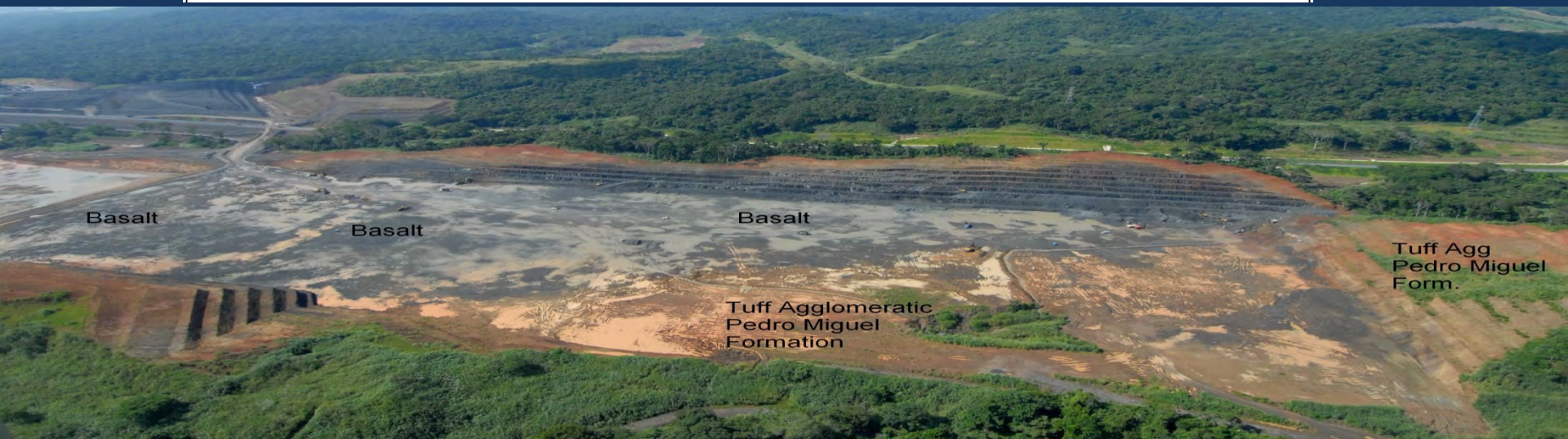
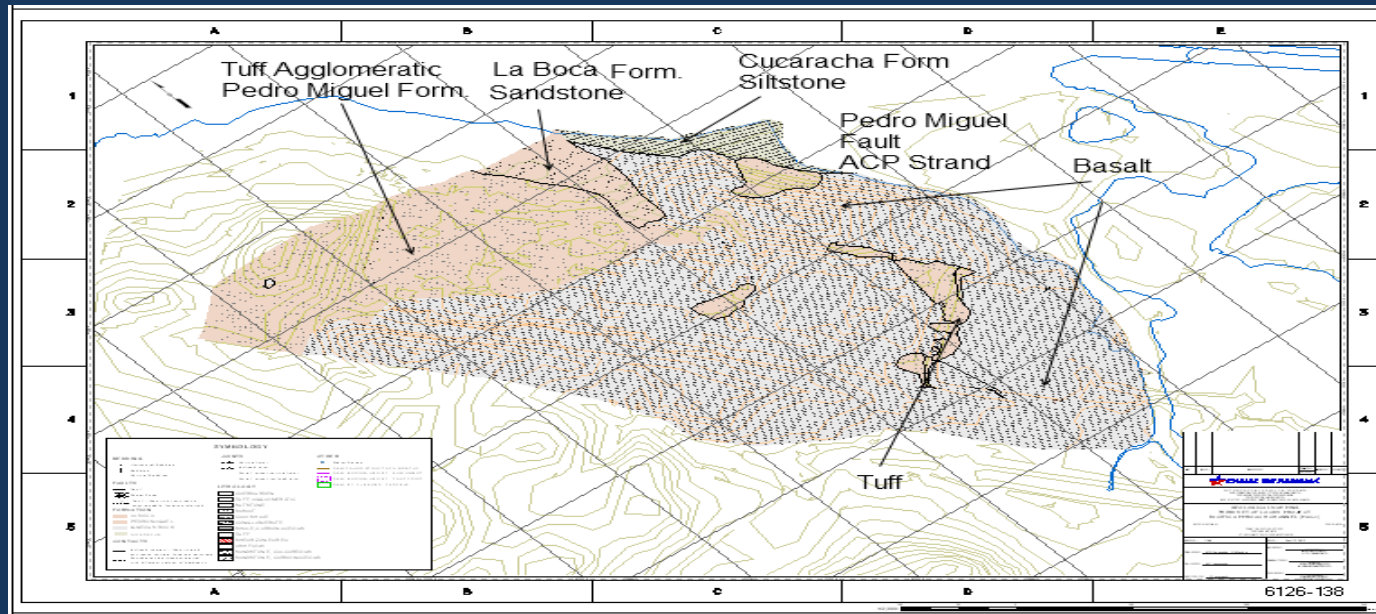
Pacific Access Channel #2 – PAC 2

Excavation of 7.5 Mm³ between stations 4P+240 and 6P+675, located north of the Pacific Post-Panamax Locks



GEOLOGIC MAP PAC-2 (4P+240 and 6P+675)

CONTACT BASALT / PEDRO MIGUEL Fm.



The geological map displays the ACP Strand area with various geological formations and topographic contours. The formations are labeled as follows:

- Tuff Agglomeratic
- Pedro Miguel Form.
- La Boca Form. Sandstone
- Guearacha Form. Siltstone
- Pedro Miguel Fault
- ACP Strand
- Basalt
- Tuff

The map includes a legend in the bottom left corner, a scale bar, and a north arrow. The legend provides details on symbols and elevations. The scale bar indicates distances in meters and kilometers. The north arrow points towards the top of the map.

6126-138

PROJECT: PAC-2
 SITE: INTERMEDIATE PLUG
 FORMATION: PEDRO MIGUE
 ROCK TYPE: TUFF AGG; TUFF
 STRUCTURE: COMPONENT OF PM FAULT.
 STRIKE AND DIP: N10W, 60NE

NAD27 COORD: N994,528; E653,750
 OBJECT ID: 1387 ELEVATION: 28 m.
 GEOLOGISTS: D. IRVING, R. MIRANDA

TUFF AGG BRECCIATED

TUFF

COMPONENT OF
 PEDRO MIGUEL FAULT

BASALT

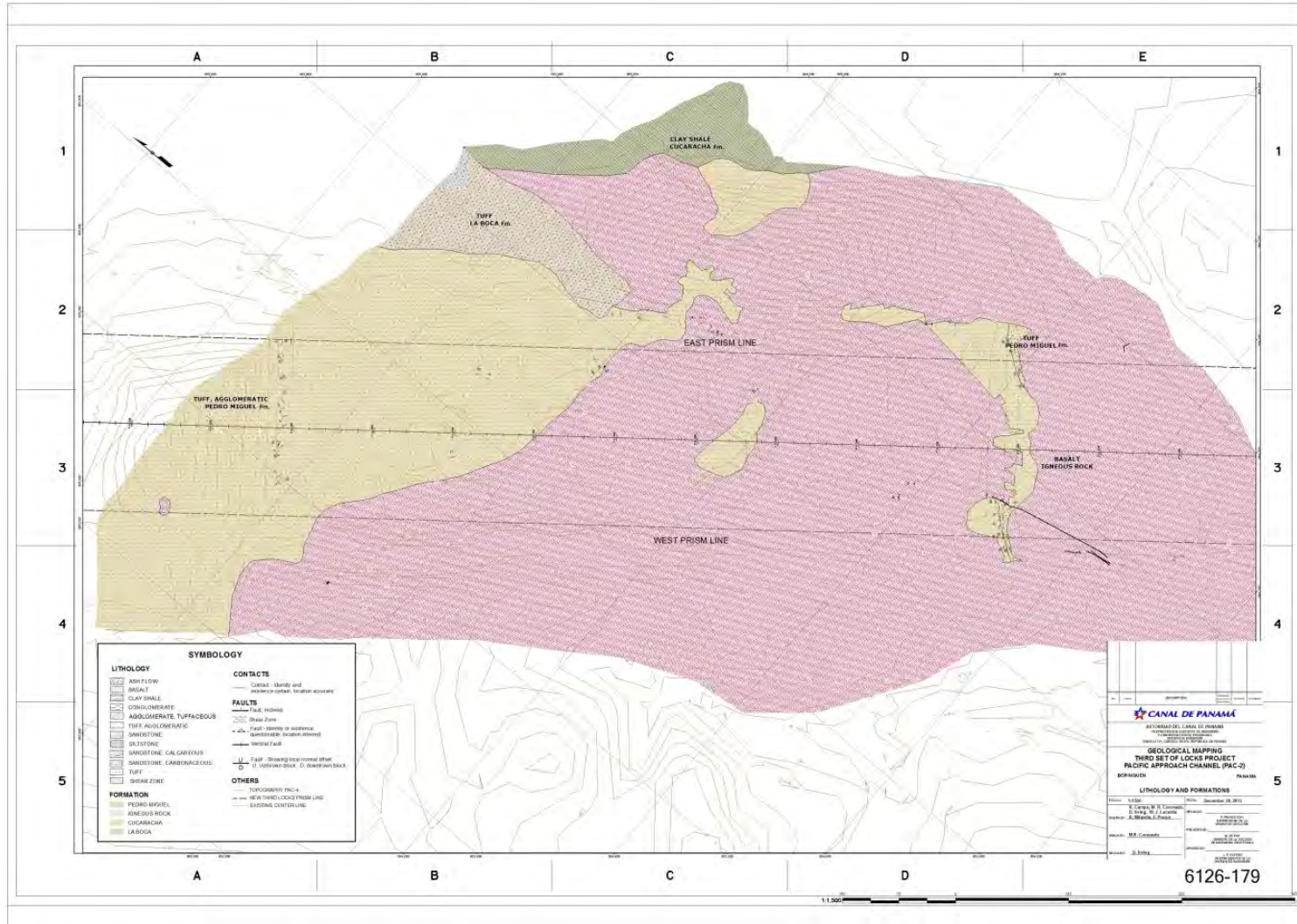
APR 16 2010 10:10
 3441 VVO map
 WGS84: 9:079,26° 03.02"
 N:008-59° 44.71"

PROJECT: PAC-2
 SITE: INTERMEDIATE PLUG
 FORMATION: PEDRO MIGUEL
 ROCK TYPE: TUFF, TUFF AGG.
 STRUCTURE: COMPONENT OF PM FAULT.
 STRIKE AND DIP: N10W, 70NE
 NAD27 COORD: N994,493, E653,755
 OBJECT ID: 1390
 ELEVATION: 20 m.
 GEOLOGIST: D.IRVING, R.MIRANDA.

TUFF, COMPONENT OF PM FAULT · TUFF AGG.

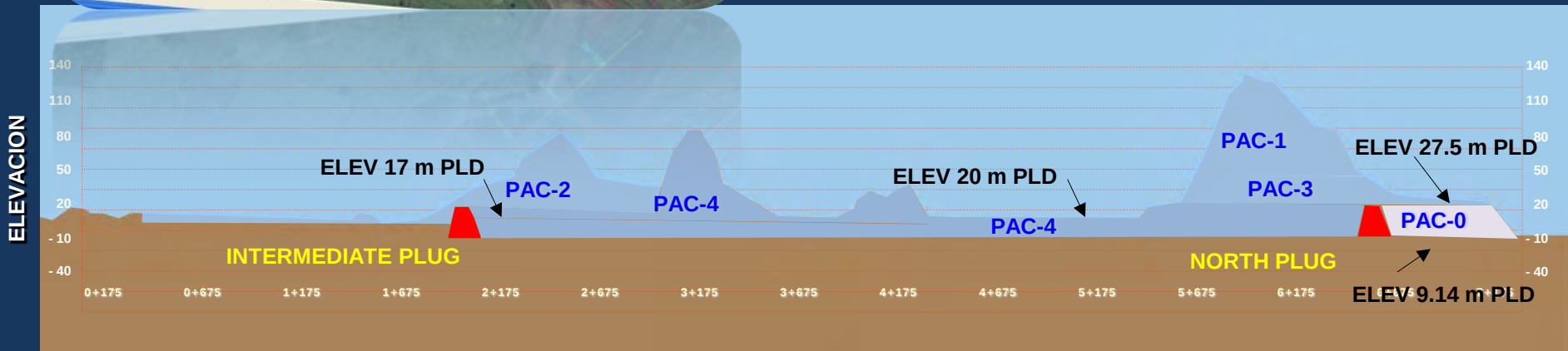
APR 16 2016 10:21
 53° 12' 44" N
 8° 47' 48" W
 0.000120 40.00°

Final Edited Geologic Map PAC-2

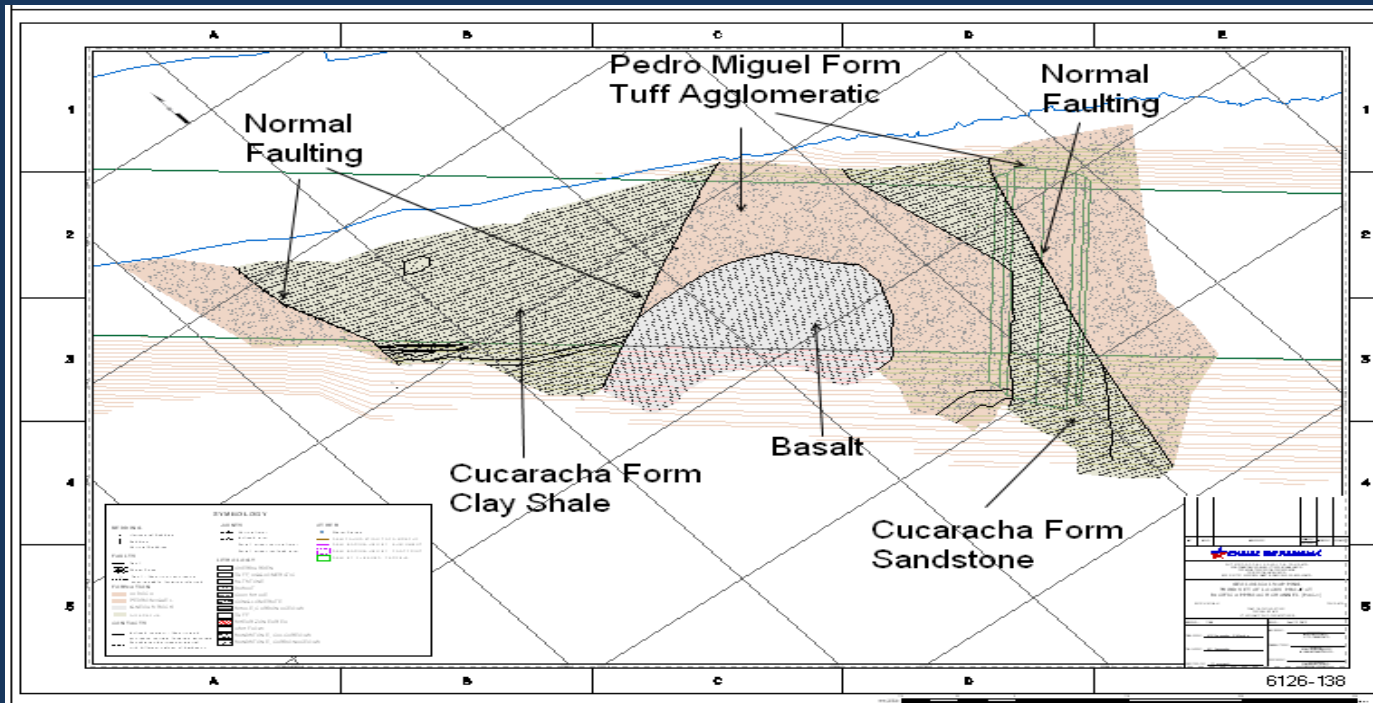


Pacific Access Channel #0 – PAC 0

Excavation/Dredging of 3.8 Mm³ between stations 0P+200 and 1P+400, located at the north side of the north plug.



Geologic Map PAC-0 – Faulted Contact Cucaracha Fm./Pedro Miguel Fm.



SYMBOLS

LITHOLOGY

- ASH FLOW
- AGGLOMERATE
- CLAY SHALE
- CONGLOMERATE
- SHALE, CARBONACEOUS
- TUFF
- AGGLOMERATE, TUFFACEOUS
- TUFF, AGGLOMERATE
- SHALE, CARBONACEOUS

FORMATION

- PEDRO MIGUEL
- IGNEOUS ROCK
- CUCARACHA

CONTACTS

- Conformity (dashed line)
- Unconformity (dashed line)
- Discontinuity (dashed line)
- Discontinuity (dashed line)
- Discontinuity (dashed line)

FAULTS

- Normal Fault (solid line)
- Reverse Fault (solid line)
- Thrust Fault (solid line)
- Strike Slip Fault (solid line)
- Unknown Fault (solid line)

OTHERS

- Topographic Contour (solid line)
- Waterway (dashed line)
- Other (solid line)

Scale

1:100,000

Map Information

Geological Mapping
Third Set of Locks Project
Pacific Approach Channel (PAC-6)

Scale: 1:100,000

Author: J. J. ...

Editor: J. J. ...

Reviewer: J. J. ...

Approved: J. J. ...

Date: December 15, 2011

Project: ...

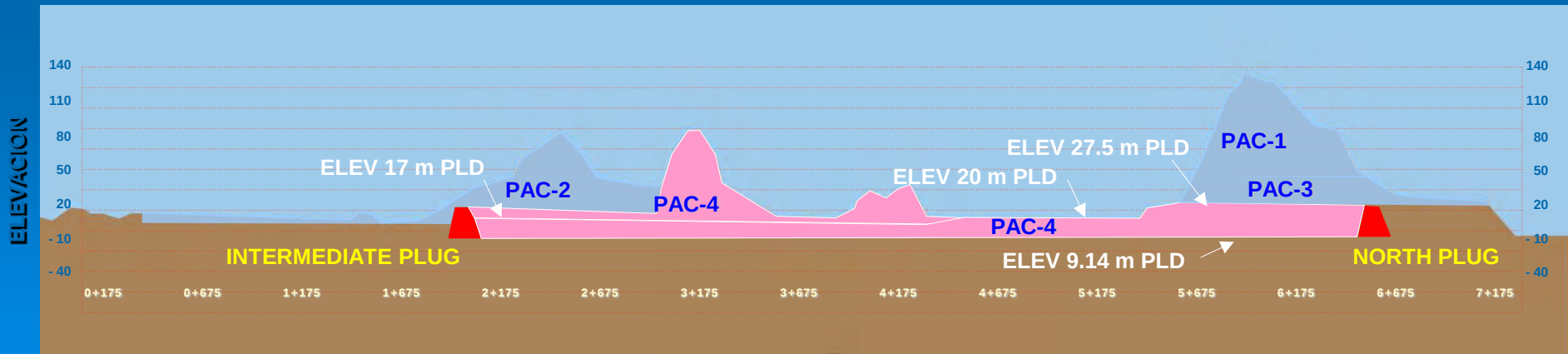
Sheet: ...

6126-177

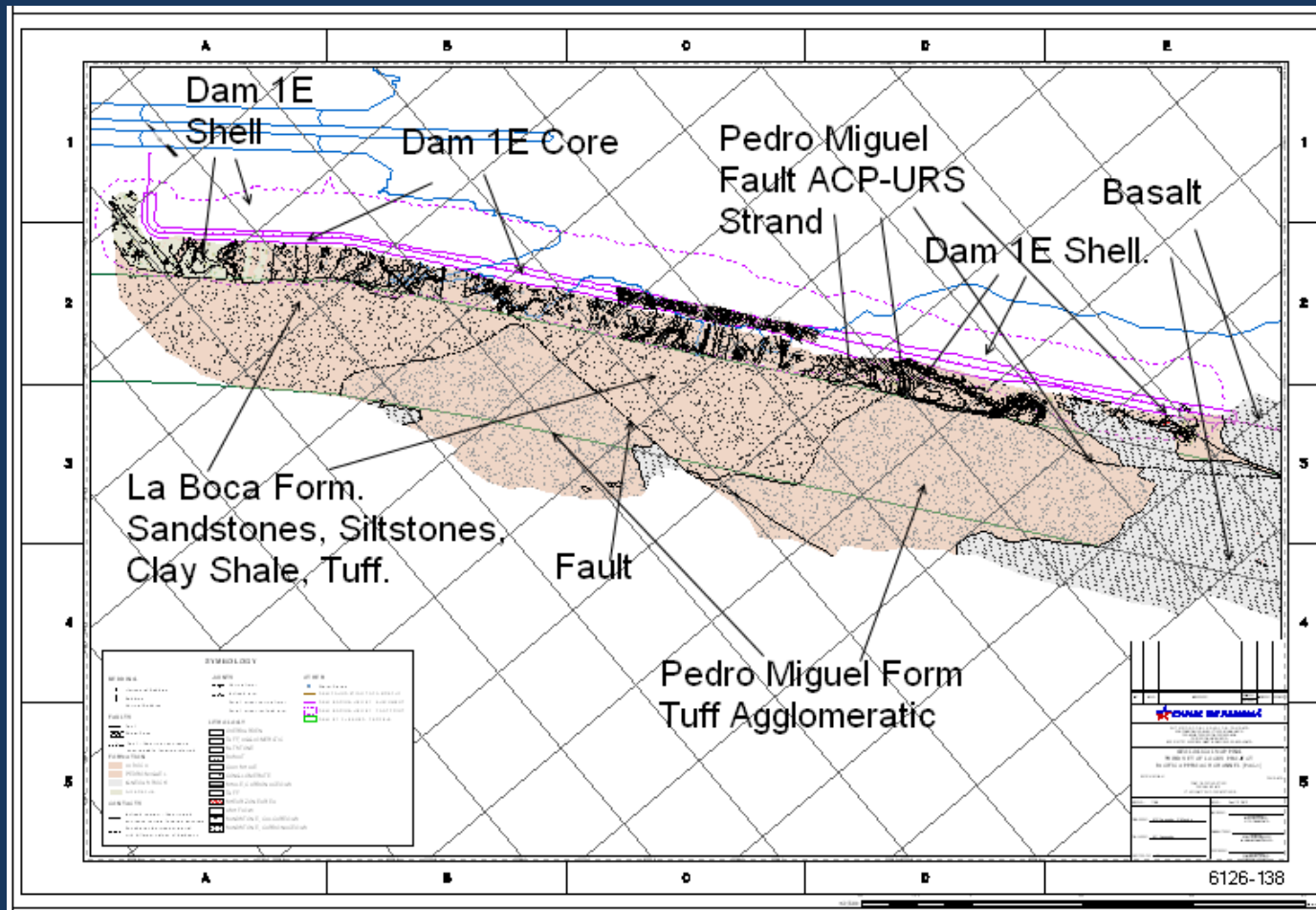


Pacific Access Channel #4 – PAC 4

Excavation of 23.0 Mm³ between stations 1P+550 and 5P+250, located between the north and intermediate plug, the construction of Dam 1E, the construction of the cofferdam system,



Geologic Map Dam PAC-4 Dam 1E Station 1P+550 and 5P+250,



Geologic Map PAC-4 Dam 1E Part 1 Northwest of Pedro Miguel Locks



STRUCTURE PAINTING / CORE MAPPING



PEDRO MIGUEL FAULT ACP-URS STRAND

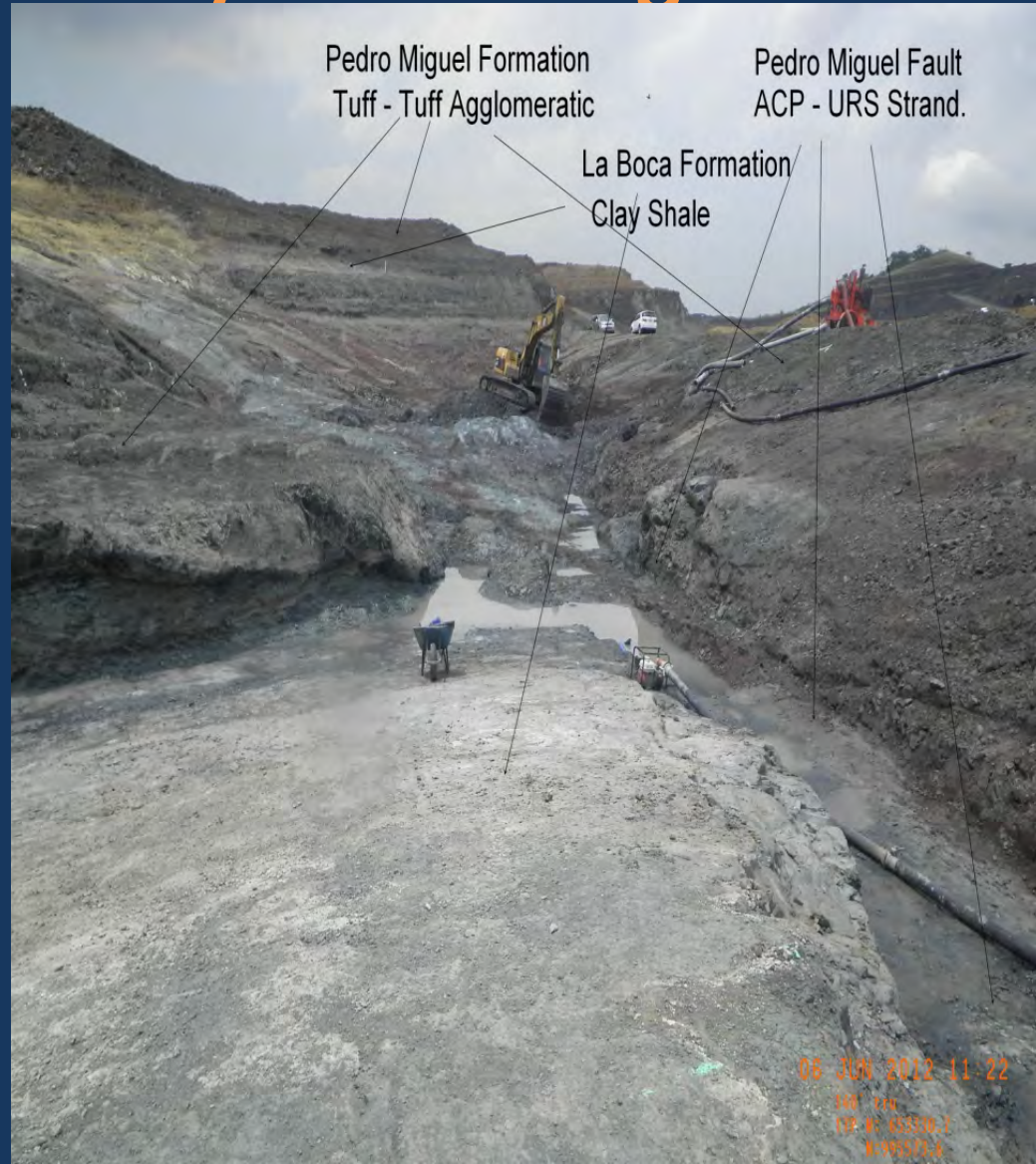


DAM 1E



Pedro Miguel Fault ACP – URS Strand

La Boca Fm./ Pedro Miguel Fm. Contact

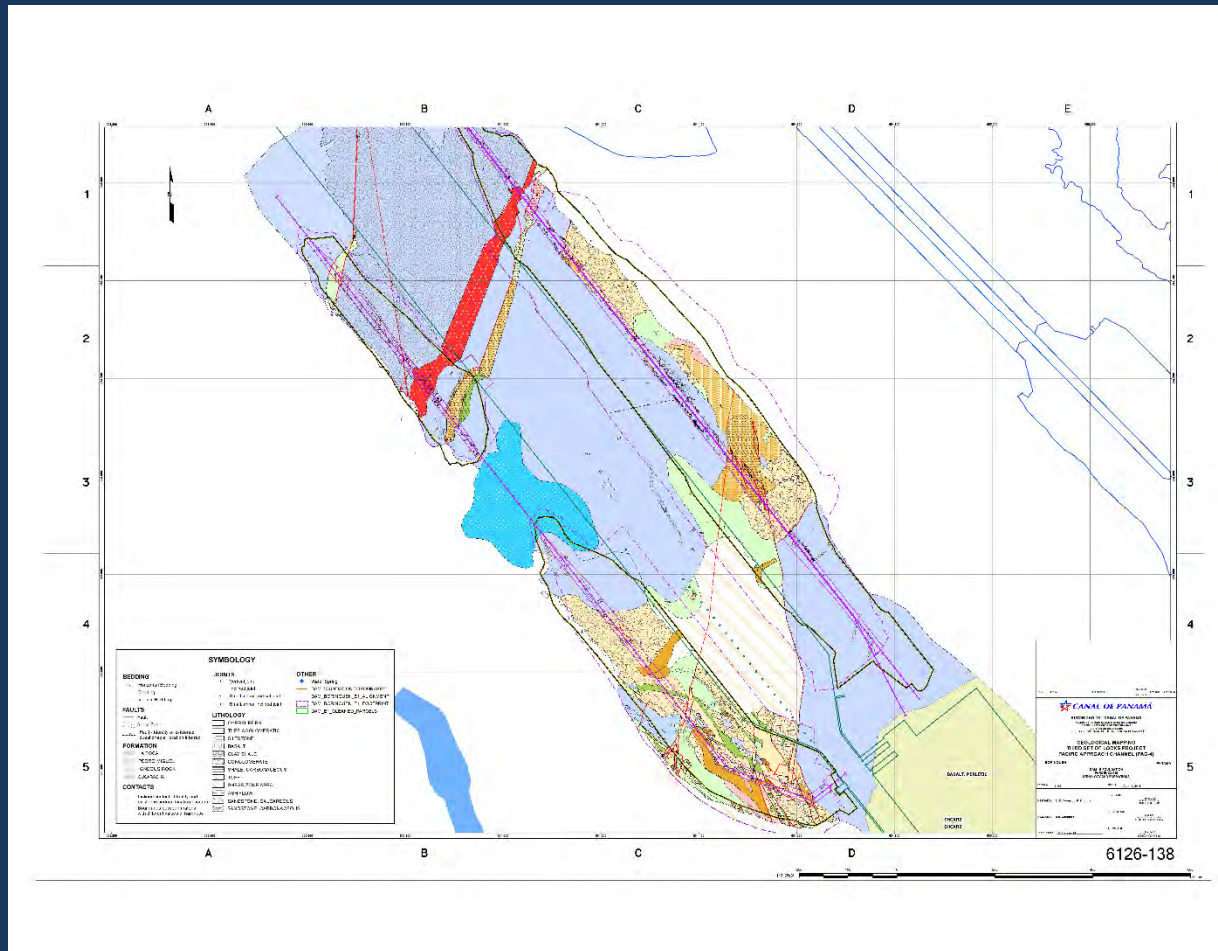


LA BOCA Fm. / PEDRO MIGUEL Fm. CONTACT



[illegible]

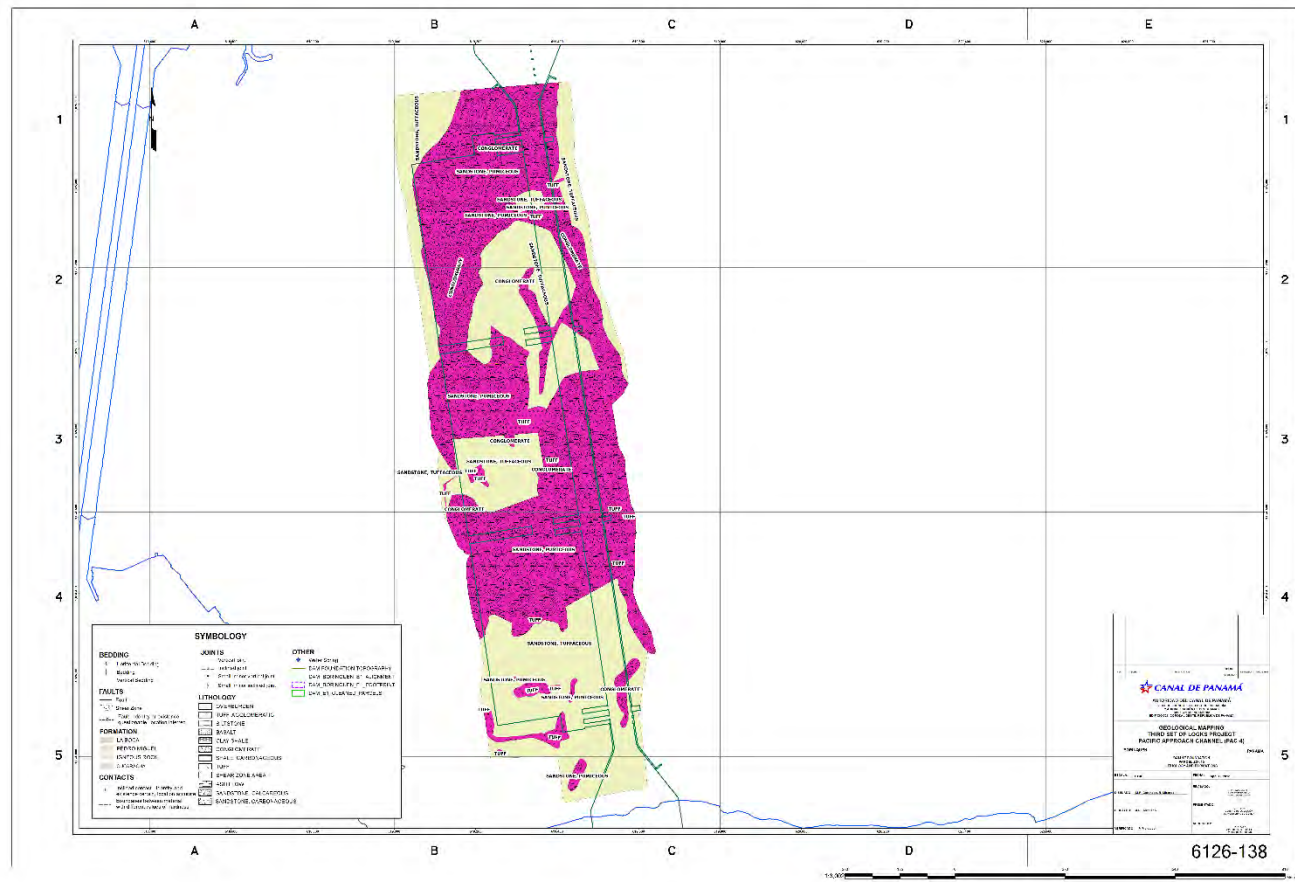
MAPA GEOLÓGICO PRESAS 2E; W-1 y W-2



Formación Gatún Esclusas Atlántico



Mapa Geológico Esclusas del Atlántico

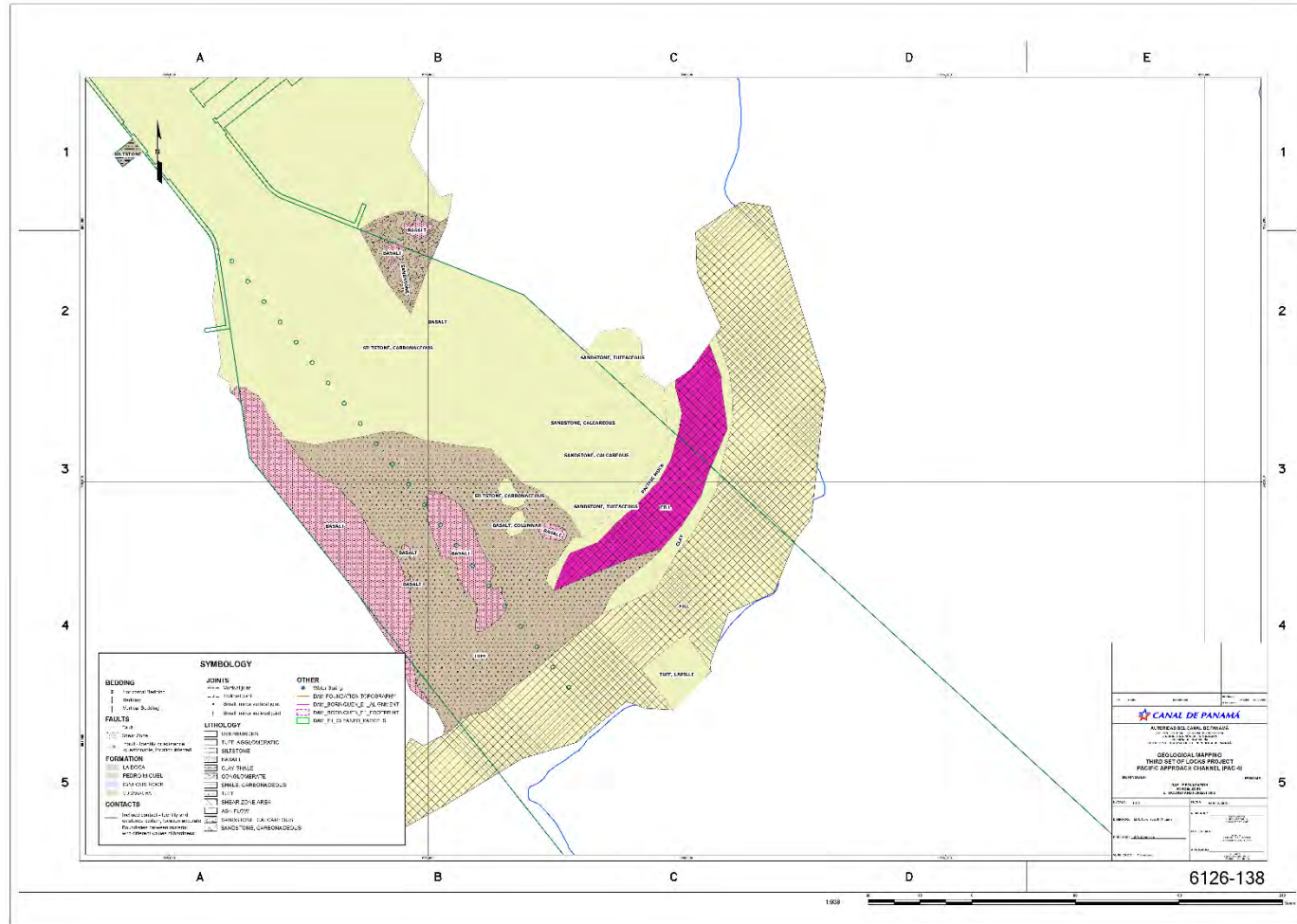


Basaltos y Esclusas Pacífico



[illegible]

Mapa Geológico South Cofferdam



Gracias



CANAL DE PANAMÁ