IPLOCA

‘’Preventing Catastrophic Losses’’

Geneva, July 11th 2013

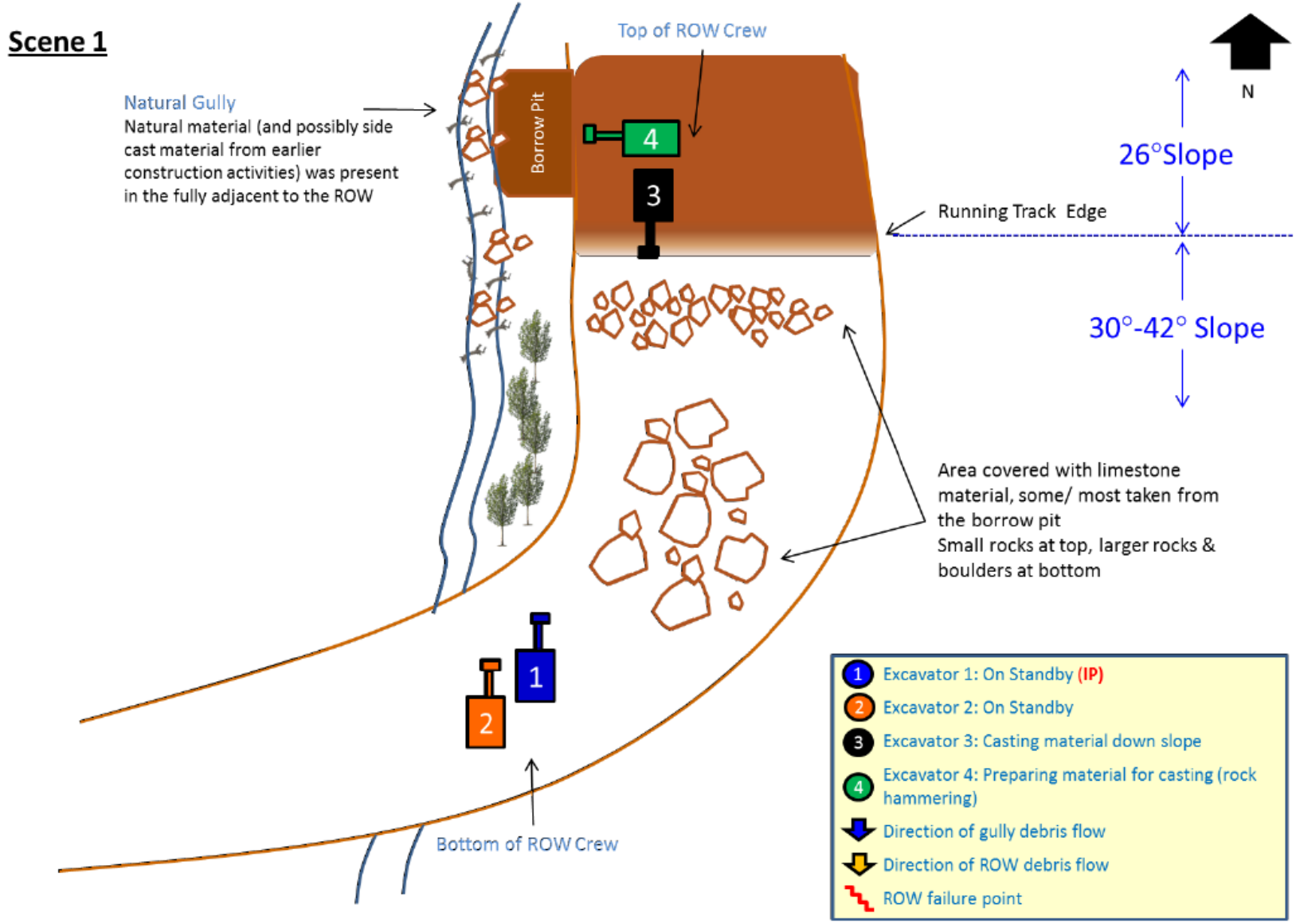
CONTENTS

- Incident description
- Root Causes
- Recommendations and Actions

Incident Summary

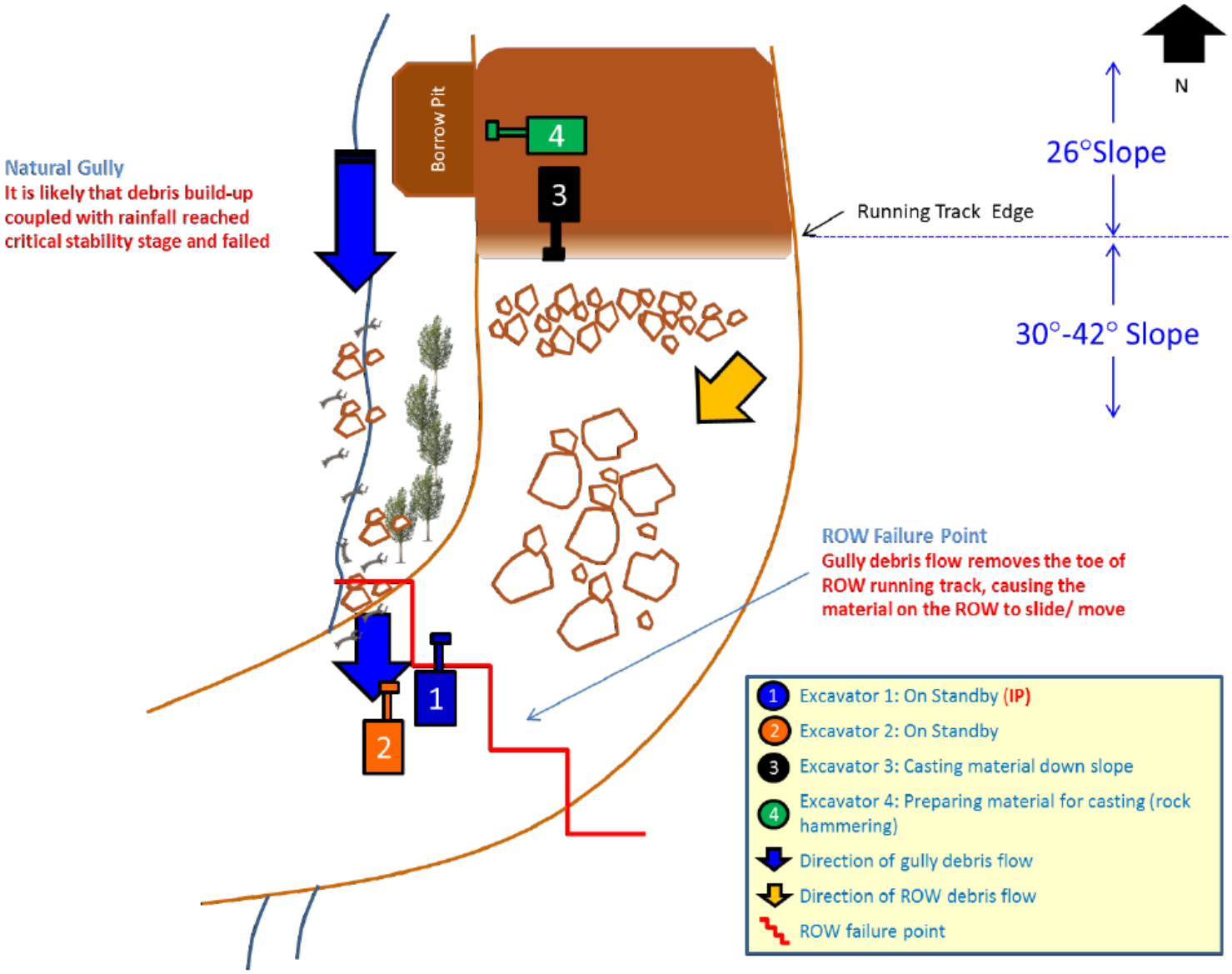
Incident Description - 1/5

Incident Description - 2/5



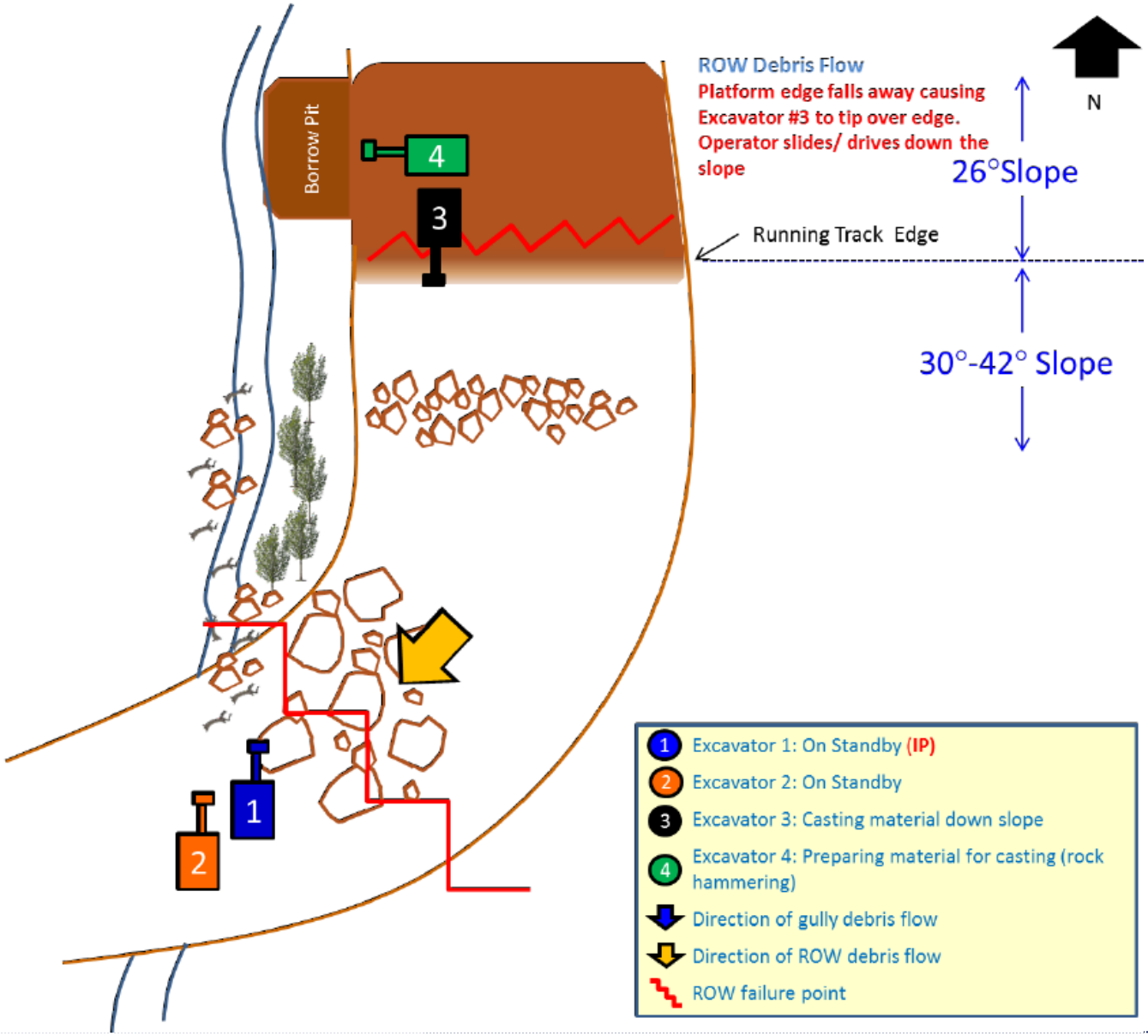
Incident Description - 3/5

Scene 2



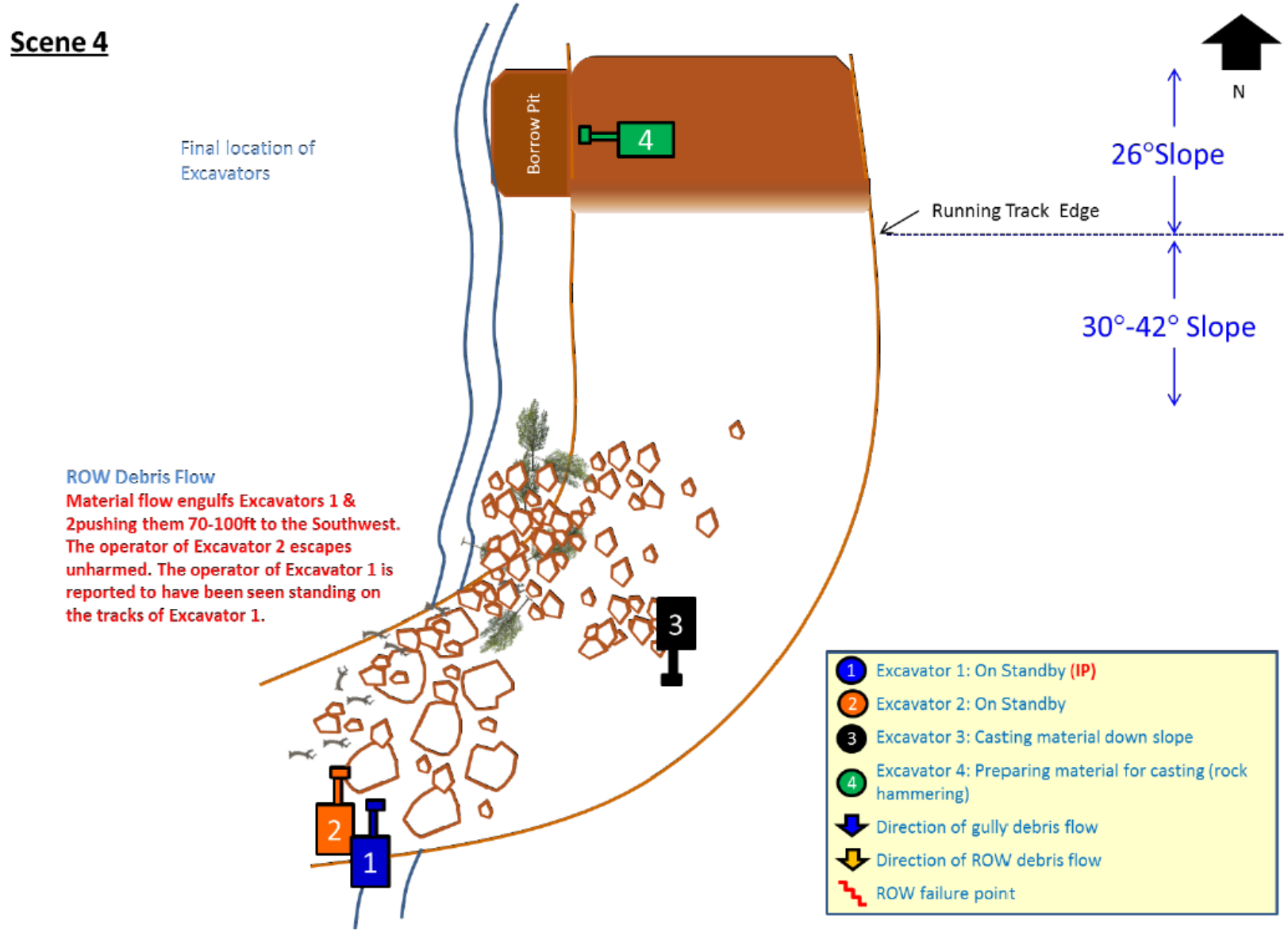
Incident Description - 4/5

Scene 3



Incident Description - 5/5

Scene 4



Root Causes

Root Causes - 1/2

Causal Factor	Root Causes	TapRoot® Terminology
1) **Occurrence of unexpected debris flow**	• Potential natural debris flow in gully. • Unstable accumulation of debris on slope and side casting in adjacent gully. • Daily rainfall. • Work methods not fit for purpose (to be confirmed). • Difficult terrain and multiple work fronts over extended area with difficult/ limited access have stretched Contractor Construction Management Team (CMT) including supporting technical resources.	▪ **Procedures** ➢ Not used/ followed: Procedure use not required but should be ▪ **Training** ➢ Task not analysed ▪ **Quality Control** ➢ No Inspection: Inspection Not Required and No Hold Point ▪ **Communication** ➢ Communication system NI ▪ **Management System** ➢ Standards Policies Admin Controls (SPAC) NI: Confusing or incomplete ➢ SPAC Not Used: Enforcement and Accountability NI ➢ Oversight: Employee relations and Feedback NI ➢ Corrective action: Trending NI ▪ **Human Engineering** ➢ Monitoring Alertness NI ➢ Complex System: Knowledge based decision required ▪ **Work Direction:** ➢ Preparation: Work Package, Pre job briefing and Walk Thru NI ➢ Supervision During Work: Crew teamwork NI
2) **RoW construction planning did not adequately recognize risk of slope instability during RoW preparation work**	• Reliance on experienced-based RoW clearing work definition and management (reliant upon multiple levels of Contractor management participation at site) particularly in higher risk environments, contrary to procedures. (Note: site supervision deficiency was not identified as a Causal Factor) • Lack of awareness of procedural requirements; lack of clear procedural guidance. • Risk not documented nor effectively communicated at the work face; not identified or discussed in the JSA.	▪ **Procedures** ➢ Not used/ followed: Procedure use not required but should be ▪ **Training** ➢ Task not analysed ➢ Decided not to train ▪ **Quality Control** ➢ No Inspection: Inspection Not Required ▪ **Communication** ➢ Communication system NI ▪ **Management System** ➢ Standards Policies Admin Controls (SPAC) NI: Confusing or Incomplete ➢ SPAC: Communication and Enforcement NI ➢ Oversight: Employee relations and Feedback NI ➢ Corrective action: Trending NI

Root Causes - 2/2

Causal Factor	Root Causes	TapRoot® Terminology
(CONTINUED) 2) **RoW construction planning did not adequately recognize risk of slope instability during RoW preparation work**		▪ **Human Engineering** ➢ Monitoring Alertness NI ➢ Work Environment: Housekeeping NI ➢ Complex System: Knowledge based decision required and Monitoring too many items ▪ **Work Direction** ➢ Preparation: Pre job briefing and Walk Thru NI ➢ Selection of Worker: Team selection NI ➢ Supervision During Work: Crew teamwork NI
3) **Excavators positioned in path of debris flow**	• Lack of recognition of risk related to worst case scenarios for debris flow. Equipment positioned out of the steep RoW, but in low area (near a gully) and adjacent to steep slope (between probable flow paths in this incident).	▪ **Procedures** ➢ Not used/ followed: Procedure use not required but should be ▪ **Training** ➢ Task not analysed ▪ **Quality Control** ➢ No Inspection: Inspection Not Required ▪ **Communication** ➢ Communication system NI ▪ **Management System** ➢ Standards Policies Admin Controls (SPAC) Not Used: Communication and Accountability of SPAC NI ▪ **Human Engineering** ➢ Complex System: Knowledge based decision required ▪ **Work Direction** ➢ Preparation: Work Package and Pre job briefing NI
4) **PPE compliance not adequate (work boots)**	• IP was recovered not wearing his footwear (i.e. work boots). May have reduced ability to escape in advance of the debris flow.	▪ **Communication** ➢ Communication system NI ▪ **Management System** ➢ Standards Policies Admin Controls (SPAC) Not Used: Enforcement NI ➢ Oversight: Employee relations and Feedback NI ➢ Corrective action: Trending NI ▪ **Human Engineering** ➢ Work Environment: Wet/Slick ▪ **Work Direction** ➢ Selection of Worker: Team selection NI ➢ Supervision During Work: Crew teamwork NI

Recommendations and Actions

Recommendations - 1/4

CF #	Root Cause to Address	#	Recommendation	Responsible Person(s)	Target Completion
1	Work methods not fit for purpose (to be confirmed).	1.1	Complete detailed assessment of construction activities and appropriateness and define lessons learned relative to specific work methods to be applied to future RoW activities.	Engineering Manager	Ongoing in Areas of High Risk Potential
	Potential natural debris flow in gully. Unstable accumulation of debris on slope and possible side casting in adjacent gully.	1.2	Include in procedures for Steep Slopes periodic checks of adjacent water courses, and potentially clear, for damming or excessive debris accumulation.	Engineering Manager	Ongoing in Areas of High Risk Potential
	Daily rainfall.	1.3	Communicate and discuss rainfall data daily with construction team, and explicitly consider appropriate, site specific, work restrictions where appropriate.	Construction Mgr & Southern Area Execution Mgr	13-Sep-12
	Difficult terrain and multiple work fronts over extended area with difficult/ limited access have stretched Contractor Construction Management Team (CMT) including supporting technical resources.	1.4	Increase Contractor CMT capacity (beyond site supervision) including supporting technical resources to deliver sufficient management of current workfaces and with consideration of upcoming complexity and challenging terrain with increase in geographical spread and site access challenges.	Project Director/ Deputy Project Director	30-Sep-12

Recommendations - 2/4

CF #	Root Cause to Address	#	Recommendation	Responsible Person(s)	Target Completion
2	Reliance on experienced-based RoW clearing work definition and management (reliant upon multiple levels of Contractor management participation at site) particularly in higher risk environments, contrary to procedures. (Note: site supervision deficiency was not identified as a Causal Factor).	2.1a	Apply fit for purpose procedural rigor to RoW preparation activities. ▪ Review existing procedures and revise, consolidate or supplement as needed, including but not limited to "RoW Stability Assessment Procedure", "Inspection and Testing Plan (ITP) – RoW Preparation" and "Working on Steep Slopes Greater than 20 Degrees" as they apply to RoW preparation.	Construction Manager & Engineering Manager	13-Sep-12
		2.1b	Apply fit for purpose procedural rigor to RoW preparation activities. ▪ Develop and implement simple (e.g. checklist-based) RoW stability risk assessment process to apply prior to start of all RoW preparation civil work. Any 'higher' risk areas would be subject to mitigation to "as low as reasonably practical" (ALARP), and 'medium' risk areas to periodic reassessment throughout pipeline construction to manage any changes.	Deputy Project Director	10-Sep-12
		2.1c	Apply fit for purpose procedural rigor to RoW preparation activities. ▪ Ensure application of supplemental requirements (e.g. Steep Slopes) is noted on Alignment sheets (e.g., explicitly or via noting risk categorization).	Construction Mgr & Engineering Mgr	13-Sep-12

Recommendations - 3/4

CF #	Root Cause to Address	#	Recommendation	Responsible Person(s)	Target Completion
2	Lack of awareness of procedural requirements; lack of clear procedural guidance.	2.2	Conduct training on application of work procedures.	Construction Manager & Engineering Manager	30-Sep-12
		2.3	Project to verify application of procedures to supplement experience based work management.	Construction Manager & Engineering Manager	13-Sep-12
	Risk not documented nor effectively communicated at the work face; not identified or discussed in the JSA.	2.4	Include debris flow risk in JSAs.	Construction Manager	13-Sep-12
3	Lack of recognition of risk related to worst case scenarios for debris flow. Equipment positioned out of the steep RoW, but in low area (near a gully) and adjacent to steep slope (between probable flow paths in this incident).	3.1	Procedure for RoW preparation required for Steep Slopes to include recognition of potential for debris flow and worst case scenario area of impact, with particular emphasis on low areas and "gullies".	Construction Manager & Engineering Manager	13-Sep-12
		3.2	Include in JSA the consideration of worst case scenario debris flow and that direction changes in the RoW can expose downhill activities to debris flow adjacent to RoW work areas; include direction to position equipment and personnel "on standby" as far as reasonably practical from potential line of fire events.	Construction Manager & Engineering Manager	13-Sep-12

Recommendations - 4/4

CF #	Root Cause to Address	#	Recommendation	Responsible Person(s)	Target Completion
4	IP was recovered not wearing his footwear (i.e. work boots). May have reduced ability to escape in advance of the debris flow.	4.1	Ensure 100% PPE compliance. Issue Flash Alerts.	Construction Manager & Safety Manager	8-Sep-12
		4.2	Senior Management to engage supervisors (Supervisor Forum) utilizing this incident as a tool to highlight importance of 100% PPE compliance.	Construction Manager & Safety Manager	23-Sep-12

Actions - 1/2

CAUSAL FACTORS	ITEM NO	ACTION REQUIRED	DATE	STATUS		OWNER
RoW construction planning did not adequately recognize risk of slope instability during ROW preparation work		Apply fit for purpose procedural rigor to ROW preparation activities.				
	1	1.1 Review existing procedures and revise/consolidate as needed, including but not limited to "ROW Stability Assessment Procedure", "ITP – ROW Preparation" and "Working on Steep Slopes Greater than 20 Degrees" as they apply to ROW preparation.	13/09/2012	RoW procedure has been jointly revised at site (and reviewed by Houston). Procedure issued by DCC for formal approval.		
		1.2 Develop and implement simple (e.g. checklist-based) ROW stability risk assessment process to apply prior to start of all ROW preparation civil work. Any 'higher' risk areas would be subject to ALARP, and 'medium' risk areas to periodic reassessment throughout pipeline construction to manage any changes.	13/09/2012	Check list has been issued and translated in Spanish.		
		1.3 Ensure application of supplemental requirements (e.g. Steep Slopes) is noted on Alignment sheets (e.g., explicitly or via noting risk categorization).	10/09/2012	Format and revision to alignment sheet agreed between CTR and CPY Alignment sheet update ongoing commencing KP 110 towards negative		
	2	Conduct training on application of work procedures		Completed on October 05th in English and 06th in Spanish		
	3	Project to verify application of procedures to supplement experience based work management.	30/09/2012	Nick Jackson allocated to RoW activities. One Geotechnical engineer under mobilization. 2nd one being sourced		
	4	Include debris flow risk in JSAs.		JSA revised to include debris flow risk		
Excavators positioned in path of debris flow	5	Procedure for ROW preparation required for Steep Slopes to include recognition of potential for debris flow and worst case scenario area of impact, with particular emphasis on low areas and "gullies".	13/09/2012	This is covered by action 1.2		
	6	Include in JSA the consideration of worst case scenario debris flow and that direction changes in	13/09/2012	JSA revised to include debris flow incident scenario while		

Actions - 2/2

CAUSAL FACTORS	ITEM NO	ACTION REQUIRED	DATE	STATUS		OWNER
		the ROW can expose downhill activities to debris flow adjacent to ROW work areas; include direction to position equipment and personnel "on standby" as far as reasonably practical from potential line of fire events.		working down hill. Subject discussed during the supervisors safety forum with all supervisors on 12-09-12.		
Occurrence of unexpected debris flow	7	Complete detailed assessment of construction activities and appropriateness and define lessons learned relative to specific work methods to be applied to future ROW activities	13/09/2012	Covered by Action 1.1		
	8	Include in procedures for Steep Slopes periodic checks of adjacent water courses, and potentially clear, for damming or excessive debris accumulation.	13/09/2012	Covered by Action 1.1 Included in ROW stability assessment checklist		
	9	Factor rainfall data daily with construction team, and explicitly consider appropriate, site specific, work restrictions where appropriate.	Closed	On going		Rain Fall data already discussed during daily meeting between CPY and CTR
	10	Increase Contractor CMT capacity to deliver sufficient management of work faces in consideration of upcoming complexity and challenging terrain with increase in geographical spread and access on site.	30/09/2012	Allocating Dave Morgan as deputy to Patrick Poulard and re-enforcing site engineering team. AGI engineering manager (Erix Watelet) was mobilised in August. Engineering Manager to be mobilised on site (early November).		
PPE compliance not adequate (work boots)	11	Ensure 100% PPE compliance. – Issue Safety Flash	12/09/12	Safety flash issued (multi languages)		
	12	Senior Management to engage supervisors utilizing this incident as a tool to highlight importance of 100% PPE compliance – To be addressed on Safety Forum	12/09/2-12	Subject has been the topic of the Supervisor Safety Forum.		

IPLOCA
INTERNATIONAL PIPE LINE
& OFFSHORE CONTRACTORS ASSOCIATION

Scope of Work

ROOT CAUSES (Joint or independent investigation?)

- Are they well identified?
  - Yes, TapRoot method has been used to identify the causes. Other methods are available in the market.
- Are there potential other causes?
  - It could have been identified that the operator did not stay inside.

ACTIONS TO AVOID FUTURE CAUSES

- Actions to avoid root causes.
- Are they enough?
  - We believe they are not enough (shut down areas? Other?)

LESSONS LEARNED

- Are they complete?
  - Geotechnical information should be wider than the ROW
  - Can IPLOCA include some new standards to address this issue?
  - IPLOCA to issue safety alerts on these event to share lessons