Building Resilience

Alberta's Approach to Hydrogeomorphic Hazards

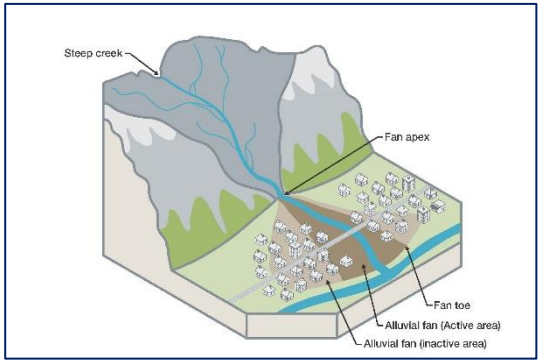
Western Flood Mapping Conference
Calgary, Alberta

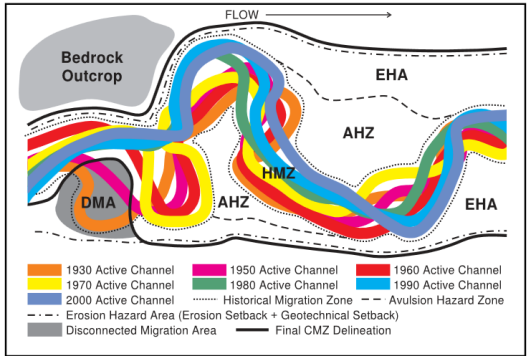
Lance Katan, P.Geo., Zahidul Islam, Ph.D., P.Eng.
Alberta Environment and Protected Areas
February 19, 2025

Overview

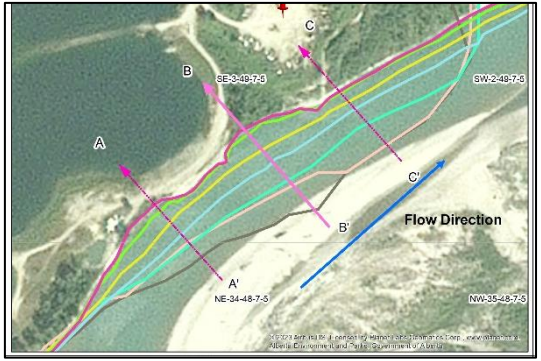
- Hydrogeomorphic Hazards in Alberta
  - Steep Creeks & Alluvial Fans
  - Channel Migration
- Alberta's Initiatives in Hydrogeomorphic Hazard Identification
  - Building awareness and education
  - Pilot projects

Hydrogeomorphic Hazards in Alberta





Steep Creeks & Alluvial Fans



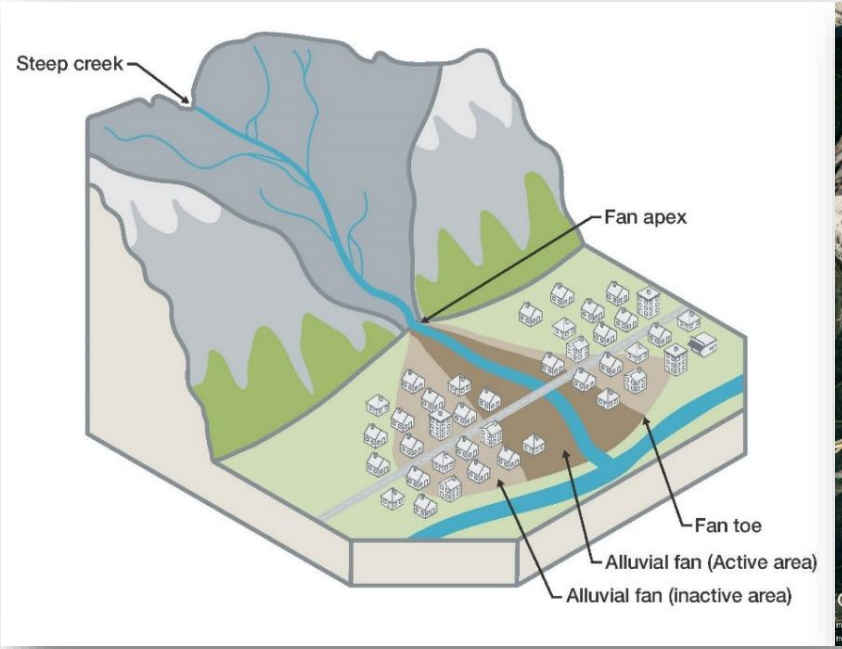
Channel Migration

Steep Creeks & Alluvial Fans

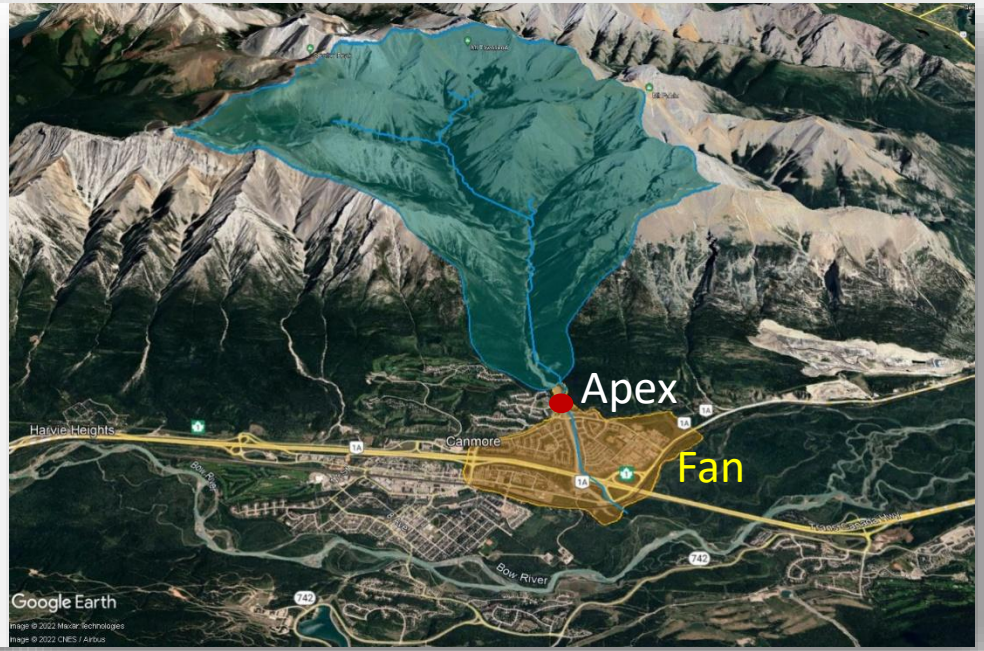
Debris Floods and Flows

Alluvial Fan Flooding

alberta.ca/alluvial-fan-flooding



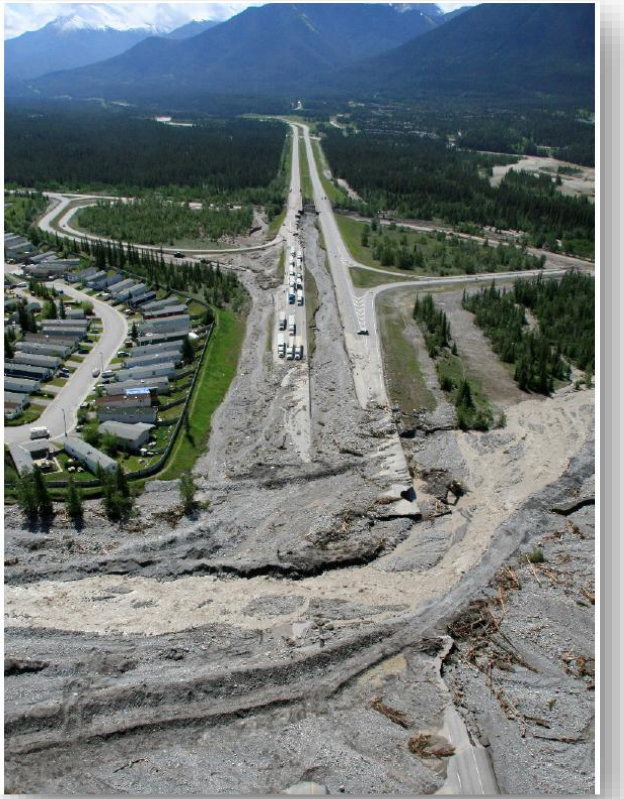
Alluvial Fan Schematic



Alluvial Fan Depicted in Mapping

Recent Debris Floods/Flows in Alberta

- Debris floods/flows have had clear impacts to communities and residents, the environment, and infrastructure.
- Recent events:
  - 2023 Waterton National Park Debris Flows.
    - Tiggered by +60 mm precip in 1-2hrs
  - 2013 Cougar Creek Debris Flood through Canmore.
    - Tiggered by ~270 mm precip over three days
    - Other events occurred throughout Municipal District of Bighorn (including Exshaw and elsewhere in Canmore) and in the Kananaskis Improvement District.



Debris Flood and Debris Flow in Alberta

Akamina Parkway (2023)

Akamina Parkway (2023)

Bear's Hump (2023)

Cougar Creek, Canmore (2013)

Exshaw Creek, Exshaw (2013)

Evan Thomas Creek, Kananaskis (2013)

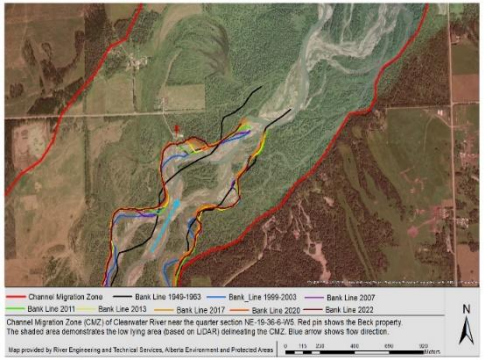
Channel Migration

Channel Migration - Examples

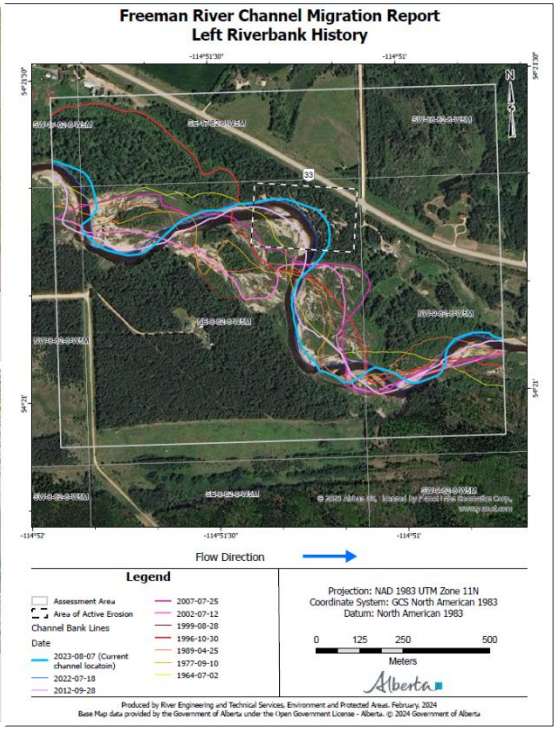
Infrastructure Impacts

NZ: Ben Hay HVDC (2023)

Regulatory Approvals Support



Clearwater River



Freeman River

Channel Migration – Examples cont.

Bow River Calgary Instream Bar Migration

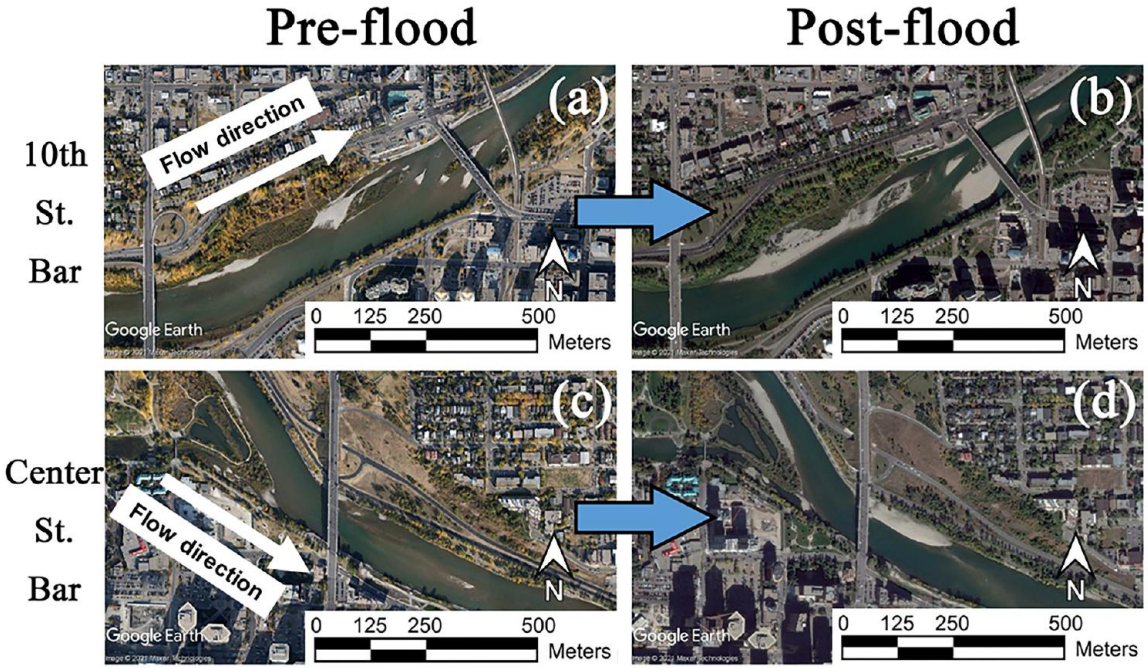


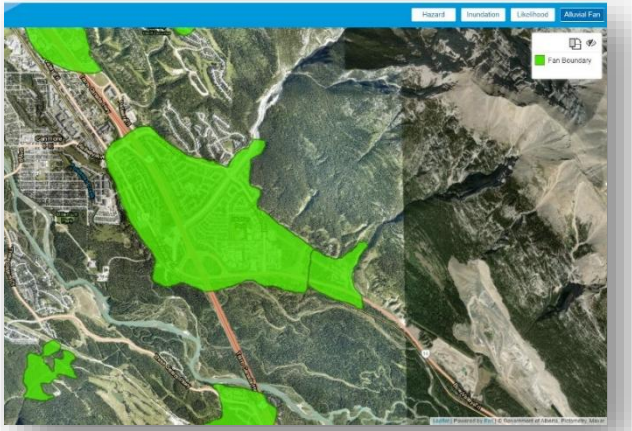
Fig. 2. Aerial photographs of the Bow River before (Sep 2012; Q ≈ $70m^3/s$; sub-figure "a" & "c") and after (Sep 2014; Q ≈ $95m^3/s$; sub-figure "b" & "d") the 2013 flood for the 10th St. bar (sub-figure "a" & "b") and the Center St. bar (sub-figure "c" & "d"). Image © Maxmar technologies, Google Image.

Yu, Qingcheng, et al. "Impact Evaluation of Instream Bar Management Using Morphodynamic Modelling." *Journal of Environmental Management*, vol. 318, 17 June 2022.

Alberta's Initiatives in Hydrogeomorphic Hazard Identification

Alluvial Fan – Alberta's Initiatives

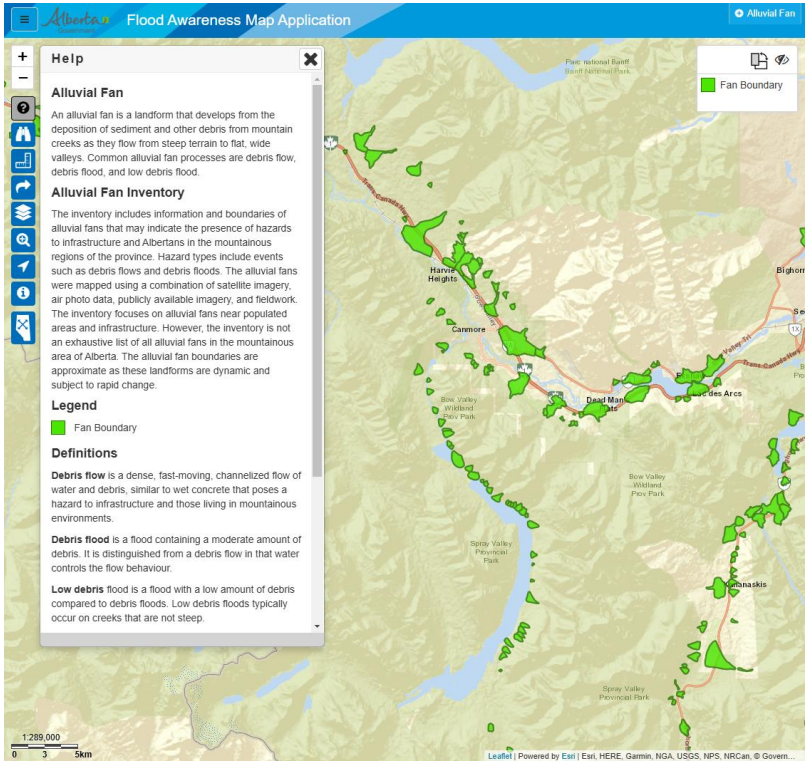
- Snapshot of Background Work
  - In 2015, an Alberta Alluvial Fan Inventory was prepared
  - In 2022, Jurisdictional Scanning (Canada, US, Europe, Asia, Oceania) was completed
  - In 2022, Municipal Engagement was Completed
  - In 2023, Alluvial Fan Inventory became accessible to the to the public via FAMA
  - Currently, continuing the development of Alluvial Fan Hazard Assessment Guidelines



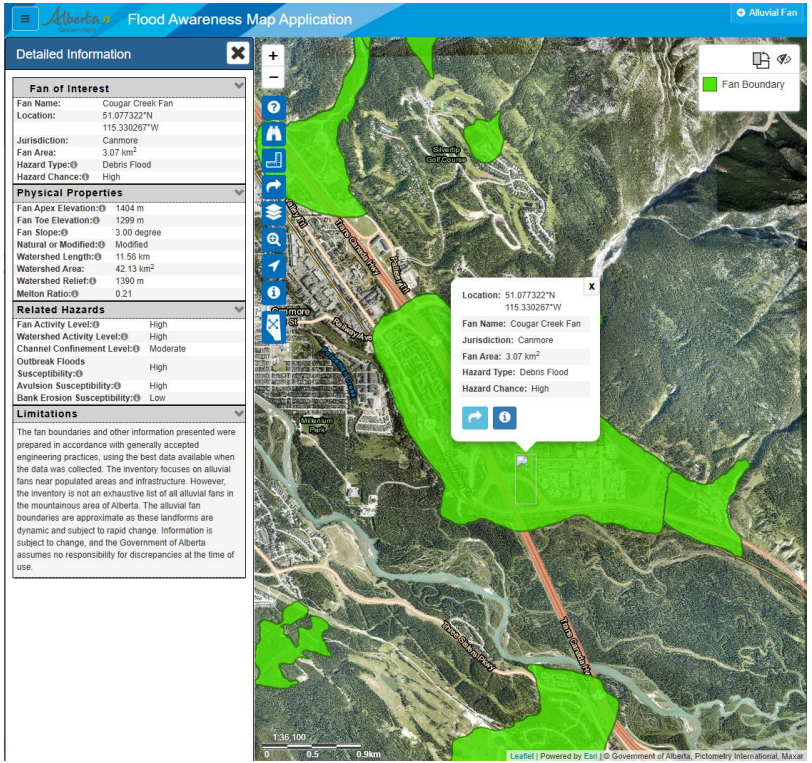
FAMA Alluvial Fan Tab
http://floods.alberta.ca/

Alluvial Fan – Inventory

Alluvial Fan Inventory Overview

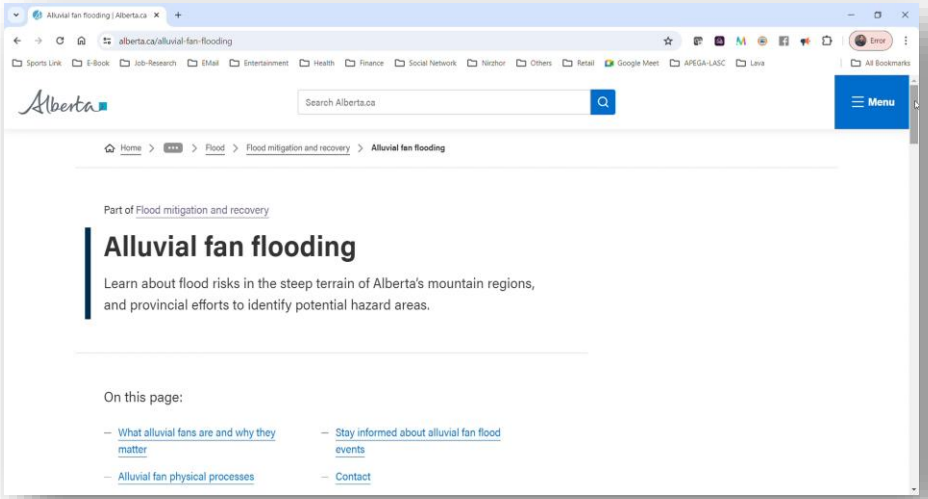


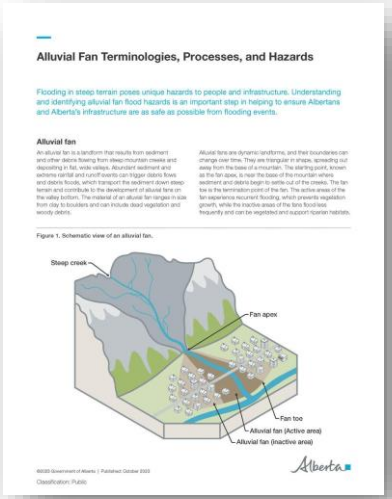
Specific Alluvial Fan Details



Alluvial Fan - Education & Awareness

alberta.ca/alluvial-fan-flooding





Alluvial Fan – Mitigation Example

alberta.ca/alluvial-fan-flooding

Nov 07, 2024

New dam protecting Canmore from floods

Alberta's government celebrates the completion of a new dam that will help protect Canmore against the flood hazards faced by the mountain community.

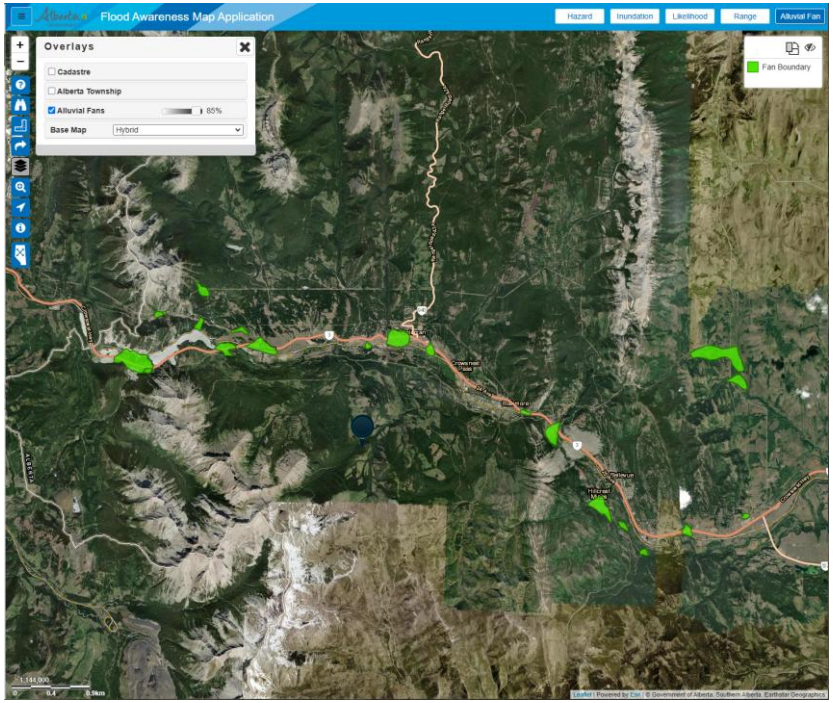
- The Alberta government produces alluvial fan studies and maps to help Albertans and affected communities anticipate potential hazards. Alluvial fan maps are available on Alberta's Flood Awareness Map Application.

Related information

- Alluvial fan flooding
- Alberta Community Resilience Program
- Flood Awareness Map Application

Hydrogeomorphic Hazard Identification – Pilot Project

- Pilot Alluvial Fan Hazard Study for the Crowsnest Pass
  - An additional component to a standard flood study under the federal Flood Hazard Identification and Mapping Program.
  - The study will assess and identify flood hazards along the Crowsnest River and its tributaries through Crowsnest Pass.
  - Additionally, the study will assess an alluvial fan under multiple frequency and geomorphic scenarios under current and projected climate.



Alluvial Fans Identified in the Crowsnest Pass

Questions and Discussion