Flood Control Planning Below Alluvial Fans

Oasis Area Stormwater Master Plan

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Presentation Objectives

• Provide a project overview and approach
• Problems associated with alluvial fans
• Project specific issues and solutions
• Benefits of the proposed Stormwater Master Plan (SMP)
Study Area
Overall Flood Risk
Oasis Area SMP Project Requirements

- Update of 2003 Hydrology with NOAA Atlas 14 rainfall data
- Update to FEMA FIS Study and FAN Analysis
- Development and alternatives analysis of SMP facilities
- Recommended Facility and Report
Oasis Area SMP Approach

- Identification and mapping of alluvial fans
  - Updated hydrologic modeling
  - Geomorphologic mapping
Oasis Area SMP Approach

• Constraints Mapping
  – Utilize geomorphology and Flo-2D mapping
  – Proposed developments (Travertine Point SP)
  – Reviewed existing facilities
  – Existing R/W and property lines
  – Environmental constraints
Issues with Alluvial Fans

• Uncertainty with Flooding
• Arid Region Hydrology – How much rainfall and how much runoff?
• Where will the storm flows go? Where can they go?
• Channel avulsion/split flows
• Debris/Sediment transport – How much to plan for?
• Environmental limitations
• Efficient collection/capture of storm flows
Hydrology Issues

- NOAA Atlas 14 Rainfall available but no published DARF’s
  - 30% increase from NOAA 2
- Oasis Area Streamflow records not available
- How to accurately determine peak flows and flood volumes?
Hydrology

Lower Peak Hydrology
- Martinez Canyon Fan
- Sheep Canyon Fan
- Unnamed Canyon Fan
- Barton Canyon Fan

Higher Peak Hydrology
- Martinez Canyon Fan
- Sheep Canyon Fan
- Unnamed Canyon Fan
- Barton Canyon Fan

Legend
Flow Depth (feet)
- 0.010 - 0.500
- 0.501 - 1.000
- 1.001 - 3.000
- 3.001 - 6.000
- 6.001 - 9.000

EASTERN COACHELLA VALLEY STORMWATER MASTER PLAN FLOODING COMPARISON
Hydrology

- Calibrated HEC-HMS model not practical due to limited stream gage data for Coachella Valley
- CVWD adapted Ordinance No. 1234.1 (March 2013) as standard design policy
  - Precipitation data NOAA Atlas 14, Volume 6, Version 2
  - DARF’s per CVWD Ordinance 1234.1
    - “For watershed areas that exceed 10 square miles, the USACE (1980)/Bechtel (1997) DARFs shall be utilized. For watersheds less than 10 square miles, a DARF of 1.0 shall be used.”
- Average increase of 15% (peak flow) at Fan Apex
Alluvial Fan Mapping Issues

• Where will the storm flows go? Where can they go?
• Utilized procedures outlined in Guidelines and Specifications for Flood Hazard Mapping Partners FEMA (2002)
  – Historical Aerial Photographs
  – Two-Dimensional Flood Models
    • FLO-2D Flood Routing Model
    • Intermap DTM surface used
  – Field Investigations
    • Geomorphology Mapping of Active/Inactive areas
    • Utilized GPS enabled tablets and cameras for documentation
Historical Aerial Photographs
Historical Aerial Photographs
Historical Aerial Photographs
Historical Aerial Photographs
Active/Inactive Delineation
Split Flow/Channel Avulsion

Flo-2D model of Martinez Canyon

Flo-2D model of Flow on AP7
Field Investigations
FEMA FAN Analysis
Sediment Management

• Analysis based upon FEMA “Fan-Model” guidance, which presumes that critical flow occurs everywhere on alluvial fan surfaces
• Corps’ SAMwin software used to predict sediment-transport rates and sediment yield
• Yang’s sediment-transport equation selected as the “best” formula for use in SAMwin software
• Sediment Yield predicted at locations immediately upstream of channel inlets
Sediment Management

- 100-year flood peak and flood hydrograph utilized
- Manning “n” adjusted to assure critical flow
- Cross-sections in SAMwin based on typical geometries for channels (e.g., width, depth, longitudinal slope, etc.)
Sediment Management

• Calculate sediment load to systems and debris basin volumes
• Equilibrium Slopes for natural channel alternative
• Determine minimum channel slopes to prevent settling
• Alternative debris basin locations
• “n” value adjustments for debris laden flows in channel
Development of SMP facility alignment

- Utilize Geomorphology and Flo-2D mapping
- Proposed Development (Travertine Point SP)
- Reviewed Existing Storm Channel Facilities
- Existing R/W and Property Lines
- Limit Environmental Impacts
Existing Facilities
Environmental Constraints
Selected Regional Facilities
Oasis Area SMP Alignment Alternatives
Oasis Area SMP Alignment Alternatives
SMP Alternatives Analysis

- 100-year storm flows routed in Flo-2D to proposed facility
- Utilized 3 regional system and 5 regional system alignments
- Assumed channel avulsion could occur for 5 system option
- Channel lining materials consist of concrete and soil cement
- Debris basin required – upstream and mid system option
SMP Alternatives Analysis

- Channel sizing based upon HEC-RAS hydraulic model
- 8 Alternatives analyzed for each system
- Included a “natural” bottom alternative
- Preliminary permit (local, state and federal permits)
- Capital, O&M, and life cycle cost analysis for each alternative
  - Maintenance included additional cost due to sediment
- Select most cost effective and environmentally acceptable SMP
Selected Plan

- 3 Regional system alignment
- Upstream debris basins
- Trapezoidal concrete channels
QUESTIONS?

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