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Approximate mean declination, 2007

data



Basemap consists of National Agricultural Imagery Program natural color aerial photography. Universal Transverse Mercator Projection, zone 12. North American Datum 1983.

SYMBOLS

Major local surface street

Known paleokarst or breccia pipe feature

R 16 W R 15 W

----- Municipality boundary

Interstate Highway

——— State Highway

Other road

113 ° 37' 30" W

Scale 1:24,000 1 0.5 0 1 2 H H H H H Kilometers





R 16 W R 15 W

113 °37' 30" W

PLATE 9 BRECCIA-PIPE- AND PALEOKARST-SUSCEPTIBILITY MAP FOR THE ST. GEORGE-HURRICANE METROPOLITAN AREA

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R 15 W R 14 W

113°30' W

EXPLANATION

Bedrock units that are known to contain breccia pipes and/or paleokarst features. These units include the Toroweap and Kaibab Formations, and the Timpoweap and Virgin Limestone Members of the Moenkopi Formation. BP/PK

DISCUSSION

Southwestern Utah is host to numerous large solution-collapse breccia pipes that have formed chiefly by dissolution of limestone. The breccia pipes
are rubble-filled vertical tubes that form and project to the surface as overlying strata collapse into buried Redwall Limestone karst caverns, which
are present only in the deep subsurface in southwestern Utah. A second zone of smaller paleokarst features exists at the contact between the
Harrisburg Member of the Kaibab Formation and the overlying Moenkopi Formation. These paleokarst features formed in both limestone and
gypsum, and are at or close to the ground surface in some areas of southwestern Utah. Historic sinkholes, likely associated with this zone of
paleokarst, have opened in or adjacent to the Virgin River and La Verkin Creek, and in some cases have intercepted all or part of the flow of those
streams. Most breccia pipes and paleokarst features in the St. George – Hurricane metropolitan area are no longer active due to the region's arid
climate and deep water table. However, with the addition of water from irrigation, onsite wastewater disposal systems, canals and reservoirs, or
other causes, or construction above existing caverns, these relict features may reactivate locally resulting in subsidence or collapse and damage to
structures, transportation and utility corridors, and reservoirs. Breccia pipes and paleokarst features also provide highly permeable pathways to the
subsurface and are of concern for wastewater disposal and ground-water pollution. Because breccia pipes and paleokarst features rarely if ever
cause rapid, catastrophic property damage or are a threat to life safety, for purposes of this study, breccia pipes and paleokarst features are
considered adverse construction conditions and not geologic hazards.
For additional information about breccia pipes and paleokarst features in the St. George – Hurricane metropolitan area, refer to the Problem-Soil-
and-Rock text document in this report.

USING THIS MAP The Breccia-Pipe-and-Paleokarst-Susceptibility Map shows the location of bedrock units in the St. George – Hurricane metropolitan area typically associated with breccia pipes and paleokarst features. The map is intended for general planning purposes to indicate where breccia pipes and paleokarst conditions may exist and special studies may be required. The UGS recommends performing a site-specific geotechnical foundation/geologic-hazards study for all development at all locations in the study area. Site-specific studies can resolve uncertainties inherent in generalized mapping and help ensure safety by identifying the need for special foundation designs or mitigation techniques. The presence and severity of breccia pipes and paleokarst features along with other adverse construction conditions and geologic hazards should be addressed in these investigations. If breccia pipes or paleokarst features are present at a site, appropriate design recommendations should be provided.

MAP LIMITATIONS The Breccia-Pipe-and-Paleokarst-Susceptibility Map is based on limited geologic and geotechnical data; site-specific studies are required to produce more detailed geotechnical information. The map also depends on the quality of those data, which varies throughout the study area. The boundaries of the susceptibility category are approximate and subject to change with additional information. Small areas of localized susceptibility may exist throughout the study area, but their identification is precluded because of limitations of map scale. Additionally, gypsum-bearing units in the study area are locally covered by a thin veneer of unconsolidated deposits. Such areas may be susceptible to sinkhole reactivation or collapse (for example Big Round Valley [Milligan, 2000] south of Bloomington); however, because subsurface information is generally unavailable, those areas are not identified on this map. This map is not intended for use at scales other than the published scale, and is designed for use in general planning to indicate the need for site-specific studies.

MITIGATION

Although potentially costly when not recognized and properly accommodated in project design and construction, problems associated with breccia pipes and paleokarst features rarely are life threatening. As with most adverse construction conditions, early recognition and avoidance is the most effective way to mitigate potential problems. However, breccia pipes and paleokarst terrain susceptible to subsidence and sinkhole formation are widespread in some areas of the St. George – Hurricane metropolitan area, and avoidance may not be a viable or cost-effective mitigation option, particularly for transportation and utility corridors and large reservoirs. Mitigation techniques include installing inverted aggregate filters, transit-mix plugs, various types of grouting, dynamic

compaction, special foundation designs such as piles, and careful drainage design to keep water away from karst features (Fischer and McWhorter, 2006





113°22'_30" W

T 40 S



