Interim Geologic Map of the Baileys Lake Quadrangle, Salt Lake and Davis Counties, Utah

by

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INTRODUCTION

The Baileys Lake 7.5′ quadrangle is located west of downtown Salt Lake City and immediately west of the Salt Lake City International Airport along the southeastern shore of Great Salt Lake. It contains the northeastern portion of the Kennecott Utah Copper Company mine waste tailings ponds, Interstate 80, agriculture and pasture land, the southern portion of the Farmington Bay Waterfowl Management Area, the International Center commercial area, landfills, migratory bird refuges, and a number of duck hunting club wetlands. Surficial geologic deposits across most of the quadrangle consist of lacustrine and deltaic deposits of late Pleistocene Lake Bonneville (30 to 12 ka), the Gilbert-episode lake (~11.6 ka), and Holocene Great Salt Lake (since ~11 ka) (Miller, 1980; Currey and others, 1988; Murchison, 1989; Oviatt and others, 1992). We consider the Gilbert-episode lake as a separate lake, rather than a phase of the Bonneville lake cycle (after C.G. Oviatt, Kansas State University, written communication, 2013). There are no bedrock exposures within the quadrangle. Exploration drill holes indicate that the contact between Quaternary and Tertiary basin-fill deposits is about 1000 to 1400 feet (300–425 m) below the surface, and that the contact between Tertiary strata and pre-Cenozoic bedrock is about 3000 to 3600 feet (900-1100 m) below the surface (Arnow and Mattick, 1968; see table 1 for well information and subsurface unit descriptions [Tu, MzpЄ] for more information). The Baileys Lake quadrangle also contains the western part of the Holocene-active West Valley fault zone (the Granger fault), which is antithetic to the Salt Lake City segment of the Wasatch fault to the east (Keaton and others, 1987). In September 2010, the Utah Geological Survey (UGS) excavated trenches to depths of 5 to 10 feet (1.5–3.3 m) across two strands of the Granger fault within the quadrangle as part of a paleoseismic investigation of the West Valley fault zone (DuRoss and Hylland, 2012; Hylland and others, in review). No previous mapping of the quadrangle has been completed at 1:24,000 scale, but a surficial geologic map by Miller (1980) covers the quadrangle at a scale of 1:100,000 (see Index to Geologic Mapping for extents of previous mapping).

METHODS

Mapping of surficial deposits by the UGS is based on age and depositional environment or origin. The letters of the map units indicate: (1) age, (2) depositional environment or origin, and (3) morphology, texture, lithology, or other distinctive characteristics of the deposits (Doelling and Willis, 1995). Mapping for the project was done on stereographic pairs of aerial photographs from the following sources: black-and-white aerial photographs at approximately 1:20,000 scale from the U.S. Department of Agriculture (USDA) Agricultural Stabilization and Conservation Service (1937, 1971), and natural color aerial photographs at approximately 1:40,000 scale from the USDA National Agriculture Imagery Program (2009). Some contacts are mapped from U.S. Natural Resources Conservation Service (NRCS) (2010) soil maps. The geologic map was made by transferring the geology from the aerial photographs to a geographic information system (GIS) database using the programs ArcGIS, VR1, and VR2 for a target scale of 1:24,000. We mapped some contacts and faults using LiDAR acquired by the UGS (available from OpenTopography, 2011). Aerial-photographic and field mapping of the Baileys Lake quadrangle was completed in 2013. We advanced approximately 50 hand-auger boreholes to depths of <1 to 9 feet (<30 cm to 3 m), which helped reveal the Holocene and Pleistocene stratigraphy (figure 1). Table 2 provides time constraints and elevations for many geologic units and is based on features produced by Lake Bonneville, the Gilbert-episode lake, and Great Salt Lake.

We created cross-section A–A′ by combining available subsurface information and gravity data from a number of sources, including Arnow and Mattick (1968), Zoback (1983), and Hill and others (1990). We also used well logs (lithologic and electronic) from exploration oil and gas wells (see table 1) to help determine the subsurface contacts between the Quaternary, Tertiary, and pre-Cenozoic strata.

SELECTED GEOLOGIC HAZARDS

The Baileys Lake quadrangle was mapped to provide the basis for identifying and delimiting potential geologic hazards in future derivative UGS geologic hazard mapping. The surficial deposits had not been mapped previously at the detail of 1:24,000 scale. Geologic hazards related to features on this map include surface fault rupture along the Granger fault of the West Valley fault zone (Keaton and others, 1987; Keaton and Currey, 1989; DuRoss and

Hylland, 2012; Hylland and others, in review) and flooding by Great Salt Lake (its historic highstand was about 4212 [1284 m] feet elevation). Other potential geologic hazards include earthquake ground shaking, liquefaction, tectonic subsidence/tilting, waves and flooding associated with earthquakes, shallow groundwater, corrosive soils, and other problem soils. Problem units include spring and marsh deposits (Qsm) in areas of shallow groundwater and clay-rich lacustrine deposits. Below is a brief discussion of the surface-faulting and climate-related lake-flooding hazards in the quadrangle. See the map unit descriptions and geologic map (plate 1) for more information and locations of these hazards and problem deposits.

A recent paleoseismic investigation in section 25, T. 1 N., R. 2 W. (DuRoss and Hylland, 2012; Hylland and others, in review) revealed that prehistoric earthquakes on the Granger fault of the West Valley fault zone have created 1- to 3-foot-high (0.4–1 m) fault scarps in the Baileys Lake quadrangle. The investigation documented four large (surface-faulting) earthquakes since the highstand of Lake Bonneville (~18 ka), the most recent having occurred about 5500 years ago. Fault movement on the West Valley fault zone is likely coseismic with movement of the Salt Lake City segment of the Wasatch fault (Hylland and others, in review). Areas near these fault traces require a detailed fault-setback investigation before building.

The historic highstand of Great Salt Lake occurred in 1873 and again in 1987 at an elevation of 4212 feet (1284 m). As mapped on plate 1, a lake-level rise to the historic highstand shoreline could potentially flood much of the low-elevation valley floor in the quadrangle and elevate shallow groundwater in the area. For planning and building purposes, land at and below this elevation should not be developed without significant mitigation for a reoccupation of the shoreline by Great Salt Lake. Land above this elevation could still be affected by elevated shallow groundwater levels in the event of a lake-level rise and potential storm wave run-up along the shoreline during high water years (Atwood and Mabey, 1995; Atwood, 2006).

HYDROGEOLOGY

Lying on the floor of Salt Lake Valley adjacent to Great Salt Lake, the Baileys Lake quadrangle is strongly influenced by the lake, other surface water, and shallow groundwater. Great Salt Lake occupies a closed basin and has fluctuated tens of feet throughout the Holocene (Murchison, 1989; see table 2). Historical elevations of Great Salt Lake have been highly variable; however, the average elevation of the lake is 4200 feet (1280 m). Other water bodies in the quadrangle have higher and varying elevations related to water-control structures used for wetlands mitigation, migratory bird refuges, and duck club ponds. Groundwater in the quadrangle has high total dissolved solids concentrations (1000 to >10,000 ppm); saline conditions are especially prevalent along the margins of Great Salt Lake (Wallace and Lowe, 2009). Perched and shallow groundwater conditions exist across much of the quadrangle. In the vicinity of the fault trenches, groundwater monitoring in piezometers documented groundwater to within about 5 feet (1.5 m) of the ground surface during the 2009–10 water year (data available at http://geology.utah.gov/databases/groundwater/site.php?site_id=50). A deep confined aquifer and shallower unconfined aquifer form the principal aquifers for Salt Lake Valley. Many of the water wells in the area flow to the surface under artesian pressure. Regionally, groundwater in the area flows toward or along the Jordan River, or toward Great Salt Lake (Wallace and Lowe, 2009).

MAP UNIT DESCRIPTIONS

QUATERNARY

Alluvial Deposits

Qal_1 **Level-1 stream deposits** (upper Holocene) – Moderately sorted, medium- to light-brown sand, silt, and minor clay; very fine to medium-grained sand; contains thin discontinuous sand lenses; subangular to angular sand grains; thin to medium bedded; sand grains are quartz, lithic fragments, and mica flakes; located along Lee Creek; mapped in active channels, floodplains, and on minor terraces less than 5 feet (1.5 m) above active channels; locally includes minor colluvial deposits along steep stream embankments; some stream deposits are channelized and include channel embankments; exposed thickness less than 10 feet (3 m).

Qat **Stream terrace deposits** (Holocene) – Moderately sorted, light olive-gray sand, silt, and minor clay; contains thin discontinuous sand lenses; very fine to medium-grained sand; subangular to angular sand grains; thin to medium bedded; sand grains are quartz, lithic fragments, and mica flakes; mapped on terraces 5 to 15 feet (1.5–5 m) above the paleo-Jordan River channel (Baileys Lake-Goggin Drain area); may include minor alluvial and colluvial deposits from nearby slopes; exposed thickness less than 10 feet (3 m)

Qaly **Young stream deposits, undivided** (Holocene) – Moderately sorted, light olive-gray sand, silt, and minor clay; very fine to medium-grained sand; contains thin discontinuous sand lenses; subangular to angular sand grains; thin to medium bedded; sand grains are quartz, lithic fragments, and mica flakes; located along the paleo-Jordan River where the river incised down through the young lacustrine and deltaic deposits (Qldy) and formed the depression that hosts Baileys Lake and its associated wetlands; mapped in abandoned meander channels, floodplains, and on minor terraces less than 5 feet (1.5 m) above active channels; locally includes a surficial loess veneer, and minor colluvial deposits along steep stream embankments; some stream deposits are channelized and include channel embankments; includes young lacustrine alluvial (Qlay) deposits mapped by Solomon and others (2007) in the Magna quadrangle, but not mapped separately in this quadrangle; correlative with stream deposits (unit fay) mapped by Van Horn (1982) in the Salt Lake City North quadrangle; loess in this unit probably correlates with the loess (unit Qldy) at the Baileys Lake paleoseismic trench site (Hylland and others, 2012; in review); exposed thickness less than 15 feet (5 m).

Qalo **Older stream deposits** (lower Holocene to upper Pleistocene) – Moderately sorted, light olive-gray sand, silt, and minor clay; very fine to medium-grained sand; contains thin discontinuous sand lenses; subangular to angular sand grains; thin to medium bedded; sand grains are quartz, lithic fragments, and mica flakes; located along Interstate 80 near 5600 West; mapped in abandoned channels and floodplains of a stream that once flowed into and through a Gilbert-episode delta (Qdo) (Murchison, 1989); could also be related to early Holocene highstand of Great Salt Lake based on elevation (see table 2); distinguished from Qdo by the lack of deltaic fans in aerial imagery; some stream deposits are channelized and include channel embankments; unit correlative with Gilbert-episode deltaic deposits in the undivided young deltaic deposits (Qldy) in the Magna quadrangle (Solomon and others, 2007), and deltaic deposits (units fdc, fdco, and fdcy) mapped by Van Horn in the Salt Lake City South and North quadrangles (1979, 1982); exposed thickness less than 15 feet (5 m).

Deltaic Deposits

Qdy **Younger deltaic deposits** (Holocene) – Poorly to moderately sorted, yellowish-brown silt, fine sand, and clay; includes natural levee deposits; sand grains are very fine to medium-grained; subangular to angular sand grains; located on the lobate paleodelta that formed at the mouth of the paleo-Jordan River channel near and including Browns Island; mapped on an elevated floodplain surface above young lacustrine mud deposits (Qlmy) where natural levee deposits form ridges and run parallel to abandoned river channels and distributary channels; natural levee deposit elevations may coincide with Great Salt Lake intermediate and highstand shorelines; distinguished from young lacustrine and deltaic deposits (Qly and Qldy) by its numerous natural levee deposits; locally includes a surficial loess veneer and buried soil; loess in this unit probably correlates with the loess (unit Qldy) at the Baileys Lake paleoseismic trench site (Hylland and others, 2012; in review); exposed thickness less than 10 feet (3 m).

Qdd **Distributary channel fill deposits** (middle to lower Holocene) – Moderately sorted, yellowish-gray to light olive-gray silt with sand and clay; includes natural levee deposits; sand is very fine to fine grained; contains thin discontinuous sand lenses; subangular to angular sand grains; thin to medium bedded; sand grains are quartz, lithic fragments, and mica flakes; located where distributary channels of a bird's foot-style delta spilled out of the paleo-Jordan River channel southwest of Baileys Lake; associated with the late Holocene highstand of Great Salt Lake based on elevation (Murchison, 1989); mapped where delta distributary channels incised down through the young lacustrine and deltaic deposits (Qldy) and deposited channel sediments and their associated natural levee deposits over Qldy; locally includes a surficial loess veneer and buried soil; loess in this unit probably correlates with the loess (unit Qldy) at the Baileys Lake paleoseismic trench site (Hylland and others, 2012; in review); exposed thickness less than 10 feet (3 m).

Qdf **Deltaic fan deposits** (middle to lower Holocene) – Moderately sorted, yellowish-gray to light olive-gray silt with interbedded sand and clay; sand is very fine to fine grained; contains thin discontinuous sand lenses; subangular to angular sand grains; thin to medium bedded; sand grains are quartz, lithic fragments, and mica flakes; located along the margins of the paleo-Jordan River channel near the Baileys Lake area and between the bird's foot-style delta distributary channels; mapped where elevated bar deposits fill the area between channels and conceal the young lacustrine and deltaic deposits (Qldy), and where crevasse splays breached the meander channel and deposited sediment; locally includes a surficial loess veneer; unit correlates with deltaic deposit (unit fm) mapped by Van Horn in the Salt Lake City North quadrangle (1982); loess in this unit probably correlates with the loess (unit Qldy) at the Baileys Lake paleoseismic trench site (Hylland and others, 2012; in review); exposed thickness less than 6 feet (2 m).

Qdo **Older deltaic deposits** (lower Holocene to upper Pleistocene) – Moderately to well-sorted, moderate to dark yellowish-brown sand, silt, and minor clay; sand is fine to medium grained; contains thin discontinuous sand lenses; subangular to angular sand grains; thin to medium bedded; sand grains are quartz, lithic fragments, and mica flakes; located south of Interstate 80 near 5600 West where older (Gilbert episode) stream deposits (Qalo) fed and eventually flowed through the delta as lake levels fluctuated; mapped where a meander channel (Gilbert-episode paleo-Jordan River?) spread out into distributary channels and formed a delta deposit; distinguished from young lacustrine and deltaic deposits (Qldy) by the deltaic fans and channels visible on aerial photography; locally includes a surficial loess veneer; unit correlative with Gilbert-episode deltaic deposits in the undivided young deltaic deposits (Qldy) in the Magna quadrangle (Solomon and others, 2007), and deltaic deposits (units fdc, fdco, and fdcy) mapped by Van Horn in the Salt Lake City South and North quadrangles (1979, 1982); loess in this unit probably correlates with the loess (unit Qldy) at the Baileys Lake paleoseismic trench site (Hylland and others, 2012; in review); Gilbert deltaic age from Murchison (1989) based on elevation and location; exposed thickness less than 6 feet (2 m).

Human-Derived

Qh **Fill and disturbed land** (historical) – Undifferentiated earth fill and disturbed land related to the construction of canals, landfills, mine tailings ponds embankments, water control structures used for wetlands mitigation, migratory bird refuges, and duck club ponds, and fill used for construction of Interstate 80 and 215; includes construction debris in landfills; only the larger areas of disturbed land are mapped, and many sites have since been regraded and developed and may contain unmapped deposits of artificial fill; unmapped fill is locally present in most developed areas, but only the larger deposits are mapped; thickest in the tailings-pond embankments in the southwest corner of the Baileys Lake quadrangle where fill is 125 to 250 feet thick (40–75 m), but other fill thickness is probably less than 50 feet (15 m).

Qht **Tailings** (historical) – Tailings from washed or milled ore from the active mining operations; mapped in large impoundments in the southwest corner of the Baileys Lake quadrangle; a smaller pond and a disposal site are mapped to the east of the large active pond.

Lacustrine Deposits

Qlmy **Young lacustrine mud deposits** (Holocene to upper Pleistocene) – Yellowish-brown to olive-gray silt, clay, and minor sand; sand is fine to medium grained; silt is unbedded with thin discontinuous stringers of clay and sand; clay is light olive-gray to olive-gray marl, and is locally mottled; the sand is olive gray to moderate brown and composed of subangular to angular grains of quartz, lithic fragments, and mica flakes; locally includes halite, gypsum, and other salts that form thin deposits on the ground surface; located on mud flats between lacustrine and deltaic sediments (Qly, Qldy), conceals deltaic distributary channels; mapped on lightly- to non-vegetated mud flats that are flooded periodically by Great Salt Lake, shallow groundwater, or occasionally by water-control structures that flood these lowlands for wetlands mitigation or ponding for duck clubs and migratory bird refuges; distinguished on aerial photographs from Qly by the characteristic, low-lying, white mud flats and lack of vegetation; includes mud flats from Holocene highstands above the historic high of Great Salt Lake; locally the silt and clay may contain ooids that have washed in from Great Salt Lake; interbedded with or laterally gradational with oolitic mud deposits (Qlom); in places the unit forms a thin veneer over the underlying Gilbert tufa breccia and clays, and Bonneville olive-gray and red-brown clays and olive-gray quartz sands (Hylland and others, 2012; in review); unit may include Gilbert or regressive Bonneville clays where the Gilbert tufa is absent; unit correlative with lacustrine mud deposits (Qlmy) in the Magna quadrangle (Solomon and others, 2007); estimated thickness less than 10 feet (3 m).

Qlom **Lacustrine oolitic mud deposits** (Holocene) – Moderately to poorly sorted, light olive-gray silt and clay, with oolitic sand; oolitic sand is fine to coarse grained and mixed in with the clay and silt, but also forms thin discontinuous sand lenses; oolitic sand forms approximately 25 to 50 percent of the mud deposit; locally the mud and oolitic sand is underlain by an olive-gray to olive-black clay and silt, and in places by Bonneville clay and sand with ostracodes; quartz and lithic sand grains are angular to subangular and ooid sand grains are rounded to subrounded; thin to medium bedded; sand grains are approximately 25 to 75 percent ooid grains, with variable quartz, lithic fragments, and mica flakes; locally includes halite, gypsum, and other salts that form thin deposits on the ground surface; located along the shorezone of Great Salt Lake where ooids are potentially forming in situ during high water or being brought onto the shorezone by wave action; locally contains flat carbonate pebbles; interbedded with or laterally gradational with young lacustrine mud deposits (Qlmy); in some locations fins and ridges of wavy carbonate 6 to 12 inches (15–30 cm) long, 4 to 8 inches (10–20 cm) tall, and 1 to 3 inches (2–7 cm) wide, are contained within the mud and oolitic sands; the carbonate fins and ridges may be the result of deformation caused by evaporative pumping tepee structures that desiccated, fractured, and then rotated to near-vertical the cemented (or partially cemented) algal mats; the carbonate fins and ridges may also be eroded remnants of algal bioherms; the wavy carbonate forms oval to circular single and double ridges that are aligned to the northwest; exposed thickness of 0 to 3 feet (0–1 m).

Qlos **Lacustrine oolitic sand deposits** (Holocene) – Moderately to well-sorted, light olive-gray to yellowish-gray oolitic sand, flat carbonate pebbles, and minor silt; oolitic sand is medium- to course-grained; quartz and lithic sand grains are angular to subangular and ooid sand grains are rounded to subrounded; flat carbonate pebble clasts are subrounded to angular; thin to medium bedded, with some oolitic sand lenses containing angular to rounded carbonate fragments 0.5 to 1 inch (1–3 cm) in diameter; sand grains are approximately 10 to 75 percent ooids (with higher concentrations near the Great Salt Lake beach ridge crest), with varying amounts of quartz, lithic fragments, carbonate pebbles, and mica flakes; flat carbonate pebble clasts are 1 to 6 inches (3–15 cm) in diameter and 1 to 2 inches (3–5 cm) thick; ooids and carbonate chips are forming in Great Salt Lake and transported onto a delta barrier bar and adjacent islands by wave action; carbonate pebbles appear to be rip-up clasts of cemented ooids and/or laminated algal mats that have washed up on the shorezone; located on the delta front of the lobate paleodelta (Qdy) that formed at the mouth of the paleo-Jordan River meander channel near Browns Island, and extends eastward on islands near the Great Salt Lake shoreline; mapped on surfaces that are elevated above young lacustrine mud deposits (Qlmy) and younger deltaic deposits (Qdy); typically overlies lacustrine silt and clay deposits; the ooid sands form two distinct layers separated by an A horizon soil; ooids can be also found in other geologic units that are below the historic highstand of Great Salt Lake and were previously flooded by the lake; samples of both the upper and lower oolitic sand deposits and the separating soil are pending analysis for carbon-14 dating; thickness 1 to 6 feet (0.3–2 m).

Qly **Young lacustrine deposits** (Holocene to upper Pleistocene) – Moderately sorted, dark yellowish-brown silt, olive-gray quartz sand, light olive-gray clay, and yellowish-gray marl; quartz sand grains are subangular to angular sand grains, fine to coarse grained; contains ooids that have washed in from Great Salt Lake during high water years; where present the ooids comprise 5 to 15 percent of the unit; underlain by Gilbert tufa breccia and clays, and Bonneville olive-gray and red-brown clays and olive-gray quartz sands (Hylland and others, 2012; in review); as mapped, unit locally includes Gilbert or regressive Bonneville clays where the Gilbert tufa is absent; mapped where lacustrine sediments form islands surrounded by or including young lacustrine mud deposits (Qlmy) and spring and marsh deposits (Qsm); distinguished from younger deltaic deposits (Qdy) and young lacustrine and deltaic deposits (Qldy) by the lack of natural levee deposits and deltaic distributary channels; distinguished from Qlmy by the presence of vegetation, the lack of mud flats, and an elevated island-like geomorphology; the lacustrine deposits have erosional and depositional Great Salt Lake shorelines on the "islands"; locally includes a surficial loess veneer and buried soil; unit correlative with young lacustrine deposits (Qly) in the Magna quadrangle (Solomon and others, 2007); loess in this unit probably correlates with the loess (unit Qldy) at the Baileys Lake paleoseismic trench site (Hylland and others, 2012; in review); exposed thickness less than 6 feet (2 m).

Spring and Marsh Deposits

Qsm **Spring and marsh deposits** (Holocene) – Silt, clay, and organic-rich sediment associated with springs, ponds, seeps, and wetlands; commonly wet, but seasonally dry; may locally contain peat deposits; overlies young lacustrine deposits (Qly); distinguished from young lacustrine mud deposits (Qlmy) by the presence of wetlands and the lack of alluvial, deltaic, or lacustrine mud flat deposits; mapped where the water table is high and ponds support the growth of tall reeds, aiding mapping on aerial photographs; some marsh deposits may be the result of impounded water and wetlands controlled by dikes and water-control actions of the duck clubs, for wetlands mitigation, and for migratory bird refuges; smaller spring and marsh deposits are not mapped due to map scale limitations; estimated thickness less than 6 feet (2 m).

Mixed-Environment Deposits

Qldy **Young lacustrine and deltaic deposits** (Holocene to upper Pleistocene) – Well to moderately sorted, light olive-gray to moderate yellowish-brown, silty sand and clay; commonly more clay rich with very little silt and sand; sand is fine to medium grained; contains thin discontinuous sand, clay, and silt lenses; subangular to rounded sand grains; thin to medium bedded; sand grains are composed of quartz, lithic fragments, and mica flakes; distinguished from younger deltaic deposits (Qdy) by its broad uniformly flat geomorphic surface along the paleo-Jordan River channels and deltas, and from young lacustrine deposits (Qly) by the presence of alluvial channels, deltaic distributary channels, and deltaic fan deposits overlying and incised into the deposit; locally includes a surficial loess veneer and buried soil; underlain by the Gilbert tufa breccia and clays, and Bonneville olive-gray and red-brown clays and olive-gray quartz sands (Hylland and others, 2012; in review), unit may include Gilbert or regressive Bonneville clays where the Gilbert tufa is absent; correlates with both young lacustrine deposits (Qly) and young deltaic deposits (Qldy) as mapped by Solomon and others (2007) in the northern part of the Magna quadrangle, as well as deltaic deposits (units ldc, ldm, fm, fdf, fdc, fdco, and fdcy) mapped by Van Horn in the Salt Lake City South and North quadrangles (1979, 1982); optically stimulated luminescence (OSL) dating of upper and lower loess deposits at the Baileys Lake paleoseismic trench site (in this unit) yielded ages of 3.2 ± 0.5 ka and 12.5 ± 1.4 ka, respectively (Hylland and others, 2012; in review); exposed thickness less than 10 feet (3 m).

Stacked-Unit Deposits

Qsm/Qaly

Spring and marsh deposits over young stream deposits, undivided (Holocene to upper Pleistocene) – A veneer of spring and marsh deposits partly conceal young stream deposits; mapped where marsh reeds and wetlands fill the lowlands created by the paleo-Jordan River channel near the Baileys Lake area; some marsh deposits may be the result of impounded water and wetlands controlled by dikes and water-control actions for wetlands mitigation and migratory bird refuges; smaller spring and marsh deposits are not mapped due to map scale limitations; estimated thickness of Qsm less than 6 feet (2 m) and the exposed thickness of Qaly is less than 15 feet (5 m).

SUBSURFACE UNITS

Qu **Quaternary deposits, undivided** – Shown on cross section only. Thickness of deposits estimated from the drill hole data.

Unconformity

Tu **Tertiary strata, undivided** – Shown on cross section only. The geophysical log of the Saltair #1 well (table 1) indicates that the Quaternary/Tertiary contact is at a depth of 1288 feet (393 m); the geophysical log of the Whitlock-Morton Salt Co. #1 well (table 1) indicates that the top of the Tertiary is at a depth of about 1430 feet (426 m), and that the Tertiary section is composed of unconsolidated sediments with approximately 300 feet (~100 m) of volcanic rock within the 2300 to 2800-foot (700-850 m) depth interval; the strata possibly include a thin interval of Salt Lake Formation (Arnow and Mattick, 1968), among other units; samples of the volcanic interval were dated at about 34 to 37 Ma (Willis and Jensen, 2000).

Unconformity

MzpC **Mesozoic to Precambrian strata?, undivided** – Shown on cross section only. The geophysical log of the Saltair #1 well (table 1) indicates a Tertiary/Precambrian contact at a depth of 3070 feet (936 m) (Willis and Jensen, 2000); the geophysical log of the Whitlock-Morton Salt Co. #1 well (table 1) indicates that the depth to consolidated rock is about 3650 feet (1113 m) (Arnow and Mattick, 1968); based on two boxes of core from the Saltair #2 well (table 1), the consolidated rock appears to be Precambrian high-grade metamorphic bedrock (Willis and Jensen, 2000); however, the wells that penetrated bedrock only represent the western portion of the mapped area, and younger Mesozoic and Paleozoic strata may be present under much of the quadrangle based on the geology of the exposed bedrock outside of the quadrangle (Van Horn, 1981; Doelling and others, 1990; Solomon and others, 2007); geology from surrounding exposed bedrock units implies that major Sevier Orogeny thrust faults are present in the Precambrian to Mesozoic strata in the subsurface but their location and exact nature are uncertain and are not represented on the Baileys Lake cross section A-A′ (Bryant, 1988; Bryant, 1990; Willis and others, 2010).

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Table 1. *Wildcat exploration drill holes in and near the Baileys Lake 7.5' quadrangle.*

API Well Number	Well Name	7.5' Quadrangle	Latitude	Longitude	Total Depth (ft)	Notes
43-035-11442	WHITLOCK-MORTON SALT CO #1	Antelope Island South	40.80631	-112.13131	4231	Plugged and abandoned
43-035-16540	JONNIE FEE #1	Baileys Lake	40.79658	-112.00159	565	Converted to a water well
43-035-16542	FROST #1	Baileys Lake	40.85080	-112.05632	1916	Plugged and abandoned
43-035-30002	SALTAIR #1	Baileys Lake	40.78945	-112.09911	3265	Plugged and abandoned
43-035-30003	SALTAIR #2	Baileys Lake	40.81804	-112.07980	3207	Plugged and abandoned
43-035-30005	GILLMOR #3	Baileys Lake	40.79176	-112.05118	2119	Plugged and abandoned

Source:
Utah Division of Oil, Gas, and Mining; http://oilgas.ogm.utah.gov/Data_Center/LiveData_Search/well_data_lookup.cfm, accessed March 23, 2013
Location data based on NAD83

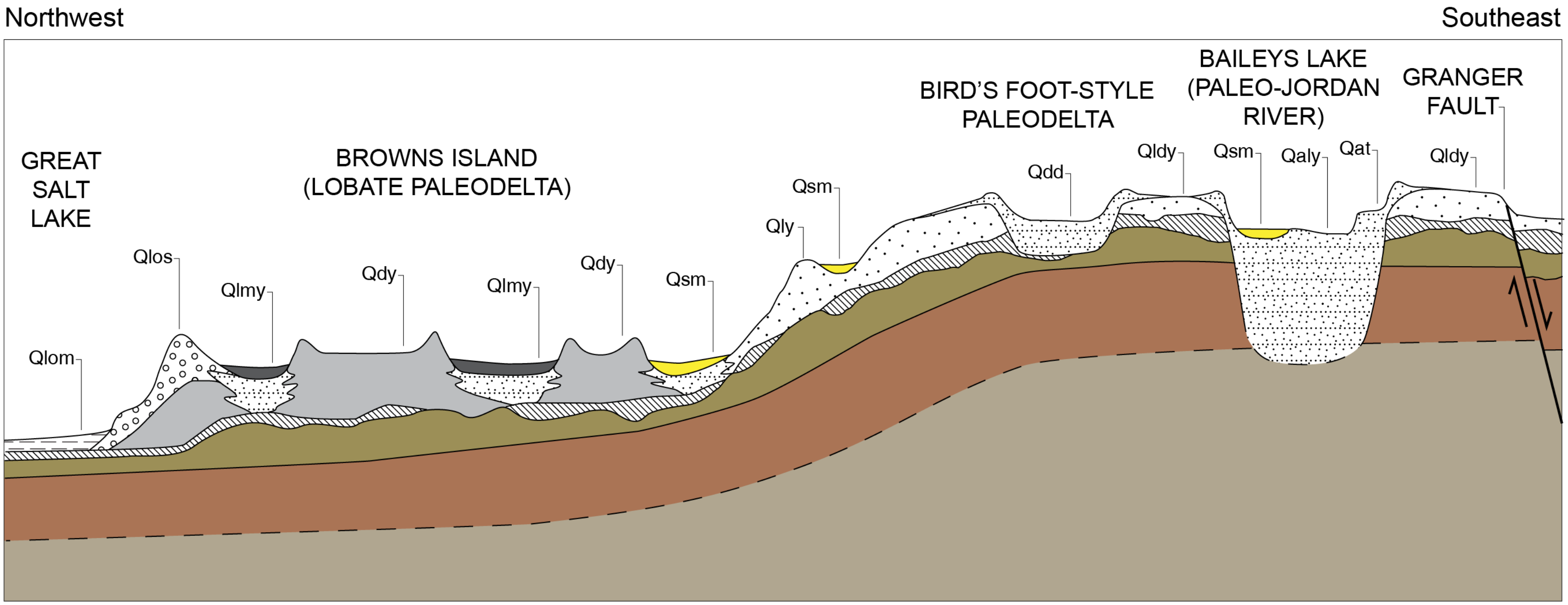


Figure 1. *Schematic cross section of surficial geology across the Baileys Lake quadrangle, showing vertically exaggerated lateral and subsurface relations of geologic units. Not to scale, for reference only.*

- Alluvial and deltaic distributary channel fill deposits (Qaly, Qdd, Qat)
- Lacustrine oolitic mud deposits (Qlom)
- Lacustrine oolitic sand deposits (Qlos)
- Spring and marsh deposits (Qsm)
- Lacustrine mud deposits (Qlmy)
- Deltaic deposits (Qdy)
- Lacustrine and deltaic deposits (Qly, Qldy)

Note:
* denotes subsurface unit only
(no map-unit symbol)

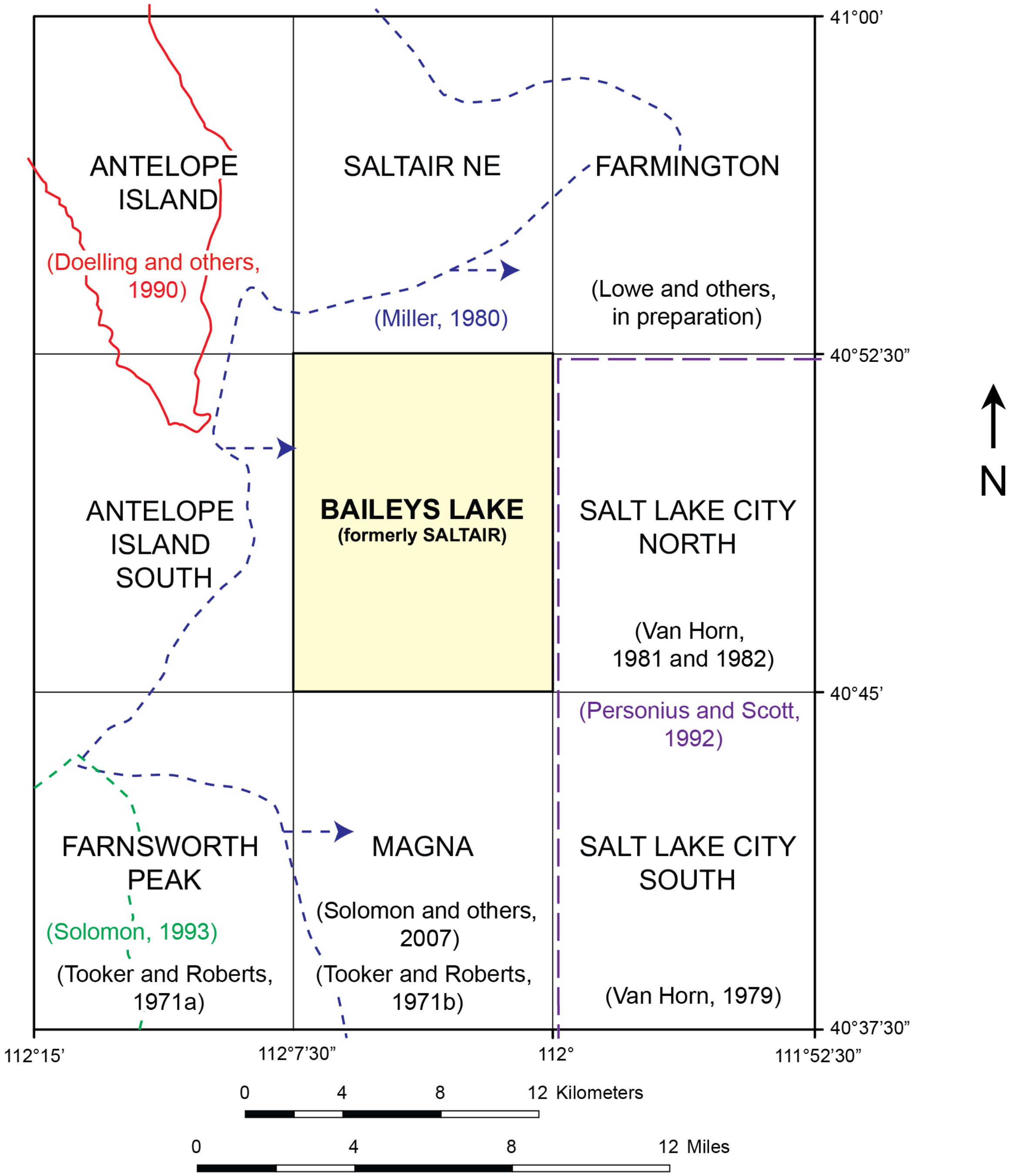
- Gilbert-episode deposits*
- Bonneville lake cycle regressive phase deposits*
- Bonneville lake cycle transgressive phase deposits*
- Pre-Bonneville deposits, undivided*

Table 2. *Ages of major shoreline occupations of Lake Bonneville and Great Salt Lake with shoreline elevations in the Baileys Lake quadrangle.*

Lake Cycle and Phase	Shoreline (map symbol)	Age: radiocarbon years (^{14}C yr) B.P.	Age: calibrated years B.P.[1]	Elevation feet (meters)
Lake Bonneville				
Transgressive Phase	Stansbury	22,000-20,000[2]	26,500-23,900	Not present
	Bonneville (flood)	15,000-14,500[3]	18,300-17,600	Not present
Regressive Phase	Provo (flood)	14,500-12,600[4]	17,600-14,800	Not present
Gilbert episode		10,500-10,000[5]	12,300-11,600	Not present
Great Salt Lake				
	early Holocene highstand	9700-9400[6]	11,200-10,700	4225-4230? (1288-1289)
	late Holocene highstand (H)	4200-2100[7]	4800-2100	4217-4221 (1285-1287)
	Historic highstand (SL)	1873 and 1987		4212 (1284)

[1] All calibration made using OxCal ^{14}C calibration and analysis software (version 4.2.2; Bronk Ramsey, 2009; using the IntCal09 calibration curve of Reimer and others, 2009), rounded to the nearest hundred years.
[2] Oviatt and others (1990).
[3] Oviatt and others (1992), Oviatt (1997).
[4] Godsey and others (2005, 2011) revised the timing of the occupation of the Provo shoreline and subsequent regression; Oviatt and others (1992) and Oviatt (1997) proposed a range from 14,500 to 14,000 ^{14}C yr B.P.
[5] Oviatt and others (2005).
[6] Murchison (1989), Currey and James (1982)
[7] Miller and others (2005)

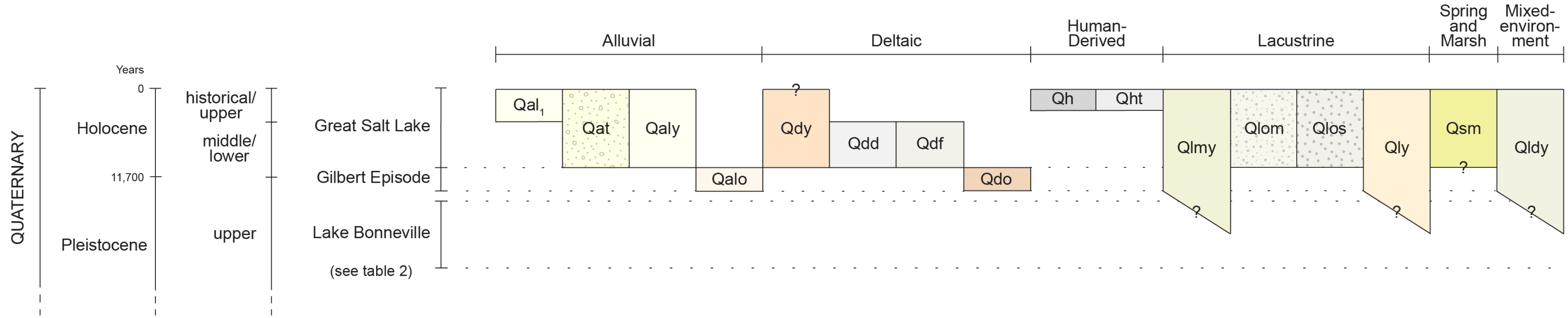
INDEX TO GEOLOGIC MAPPING

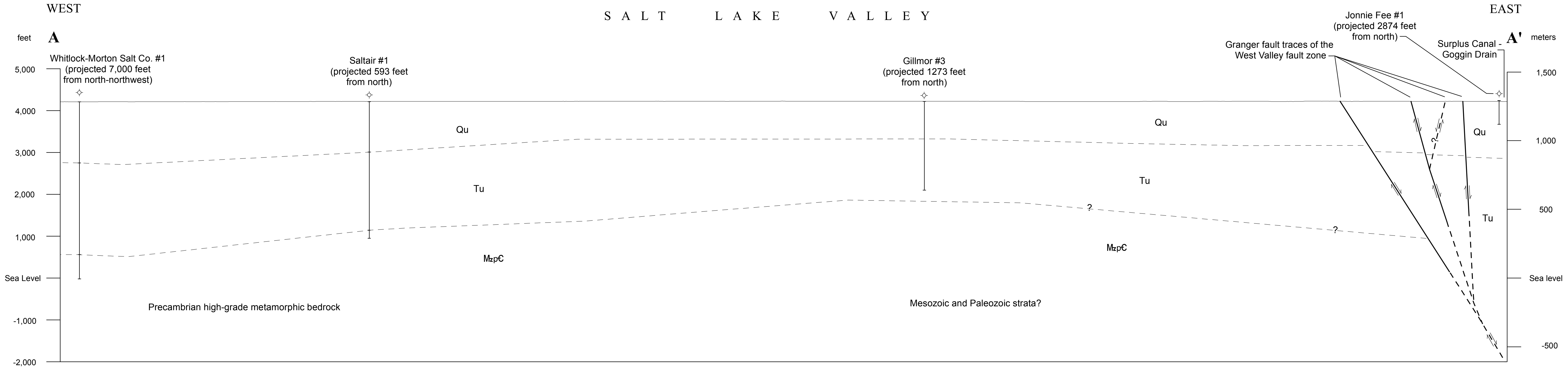


GEOLOGIC SYMBOLS

	Contact – Dashed where approximately located, dotted where concealed
	Normal fault – Dashed where approximately located, dotted where concealed; bar and ball on downthrown side; arrows on cross section indicate direction of relative movement
	Lacustrine shorelines – Major shorelines of Great Salt Lake. Mapped at the wave-cut bench of erosional shorelines and the top of constructional bars and barrier beaches; may coincide with geologic contacts:
H	Great Salt Lake late Holocene highstand shoreline
I	Great Salt Lake intermediate shoreline
SL	Great Salt Lake historic highstand shoreline
	Great Salt Lake beach ridge crest
	Natural levee deposits, may coincide with Great Salt Lake shorelines
A——A'	Line of cross section
	Spring
	Water well (selected)
	Oil and gas exploration well, plugged and abandoned
	Paleoseismic trench (DuRoss and Hylland, 2012; Hylland and others, in review)
Qsm/Qaly	Stacked unit – Denotes thin cover of first unit overlying second unit

CORRELATION CHART





Thin surficial deposits not shown
See table 1 for well information
Modified from Arnow and Mattick (1968), Zoback (1983), and Hill and others (1990)

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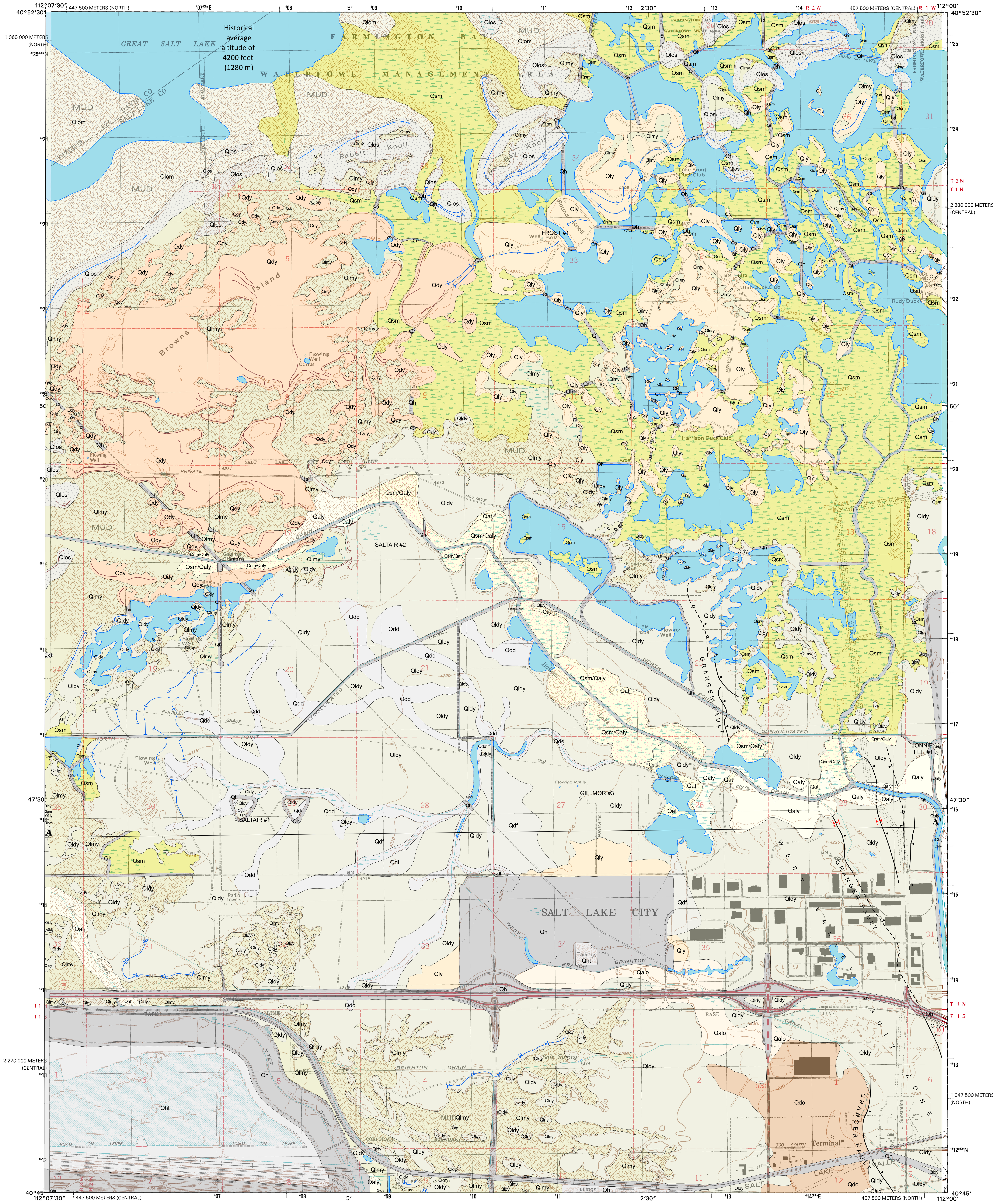

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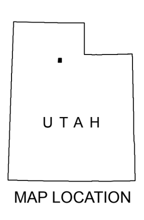
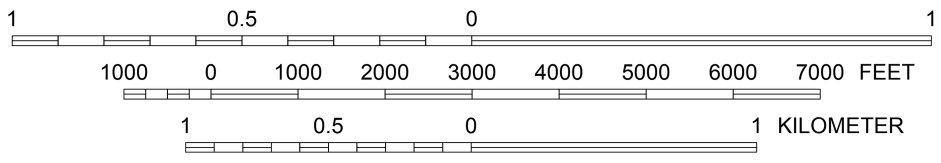


MAP LOCATION

SCALE 1:24,000



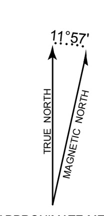
CONTOUR INTERVAL 5 FEET

INTERIM GEOLOGIC MAP OF THE BAILEYS LAKE QUADRANGLE, SALT LAKE AND DAVIS COUNTIES, UTAH

by

Adam P. McKean and Michael D. Hylland

2013



APPROXIMATE MEAN DECLINATION, 2013

1	2	3
4		5
6	7	8

1. Antelope Island
2. Saltair NE
3. Farmington
4. Antelope Island South
5. Salt Lake City North
6. Farnsworth Peak
7. Magna
8. Salt Lake City South

ADJOINING 7.5' QUADRANGLE NAMES

Base from USGS Baileys Lake [formerly Saltair] 7.5’ Quadrangle (1997)
Projection: UTM Zone 12
Datum: NAD 1983

The topographic base map appears shifted because the newer base map, published in 1997 using the North American Datum of 1983 (NAD 83), was used to show recently developed areas. The geology is projected to the NAD 27 quadrangle boundary to conform to adjoining geologic maps. The geology is accurately shown relative to topographic features on the base map.

Project Manager: Donald L. Clark
Aerial photo and field mapping of geology: Adam P. McKean, 2012-2013
GIS and Cartography: Adam P. McKean

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This map was created from Geographic Information System (GIS) data.