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LIMITED REPORT

Geology and Groundwater Resources of the Yorkton Area (62M,N), Saskatchewan

by

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Resources Division

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INTRODUCTION

Geologic mapping, test drilling, and water well drilling and measurements have been done for the entire settled area of Saskatchewan during the past 25 years. This data provides a basis for the evaluation of the groundwater resources of Saskatchewan. The objective is to continuously improve the understanding of provincial groundwater resources in terms of occurrence, quality, and behaviour, in order to support the development, management, and protection of these water supplies.

With this need in mind, the Saskatchewan Research Council (SRC) has worked co-operatively with the Saskatchewan Water Corporation (SWC) to compile a new Geology and Groundwater Resource map series corresponding to the 1:250,000 NTS areas of Saskatchewan. The present report accompanies the preliminary maps and cross-sections depicting the geology and groundwater resources in the Yorkton area (62M, N). This work, which is an update of maps published during the late 1960's and 1970's, in particular Cherry and Whitaker (1969), indicates the location, extent, and depth of aquifers throughout the area. It also demonstrates the close relationship of soil salinity to geology and groundwater conditions and assists in evaluating irrigation potential and contamination hazards.

Preliminary compilation is done at a scale of 1:100,000. Control is provided by stratigraphic cross-sections that are spaced approximately 14 to 19 km apart; ideally, one cross-section every one and one-half townships; resulting in about 15 sections per map area. The original cross-sections (horizontal scale = 1:50,000;

vertical exaggeration = 20x), are constructed by fixing reduced copies of testhole logs to the topographic section. The testhole logs used are taken from records stored at SRC and include primarily testholes with electrical logs, such as oil and potash testholes, and testholes and water wells drilled by SRC or with the assistance of SWC, or formerly, the Family Farm Improvement Branch. Records containing a driller's log only are used in the few areas where other data are sparse or lacking.

In order to keep the maps to a manageable size, the area is divided into NE, SE, NW, and SW quarters. The maps with each quarter are at the 1:100,000 scale. Separate sheets are produced for each stratigraphic level that contains aquifers or potential aquifers (i.e. sands and gravels). In some cases, where there are few, or only minor, occurrences of the deposits at different levels, aquifers at different levels may be shown on one sheet. Each area may have as many as 8 sheets per quarter, or 24 sheets for the total NTS area, including bedrock surface maps. Information on aquifer maps includes the surface elevation at the site, as well as depth to and thickness of the deposit, and the static water level when known.

When the maps are complete, the quarters are combined into one map and reduced to a scale of 1:200,000. The cross-sections are reduced by 50% to a scale of 1:100,000. This provides a compilation of all the information at a more manageable size although the legibility of the final maps is reduced due to the small size of the type.

GEOLOGY

General

All sediments between the bedrock surface and the present surface are considered to be "drift". The drift in the Yorkton area ranges in recorded thickness from 2 m to over 233 m. The drift is thickest in the southwest part of the area in the Beaver Hills. The drift is thinnest in the northeast and around Yorkton where testholes record as little as 4 m overlying the Tertiary-Quaternary bedrock.

Meltwater channels, now occupied by the Swan River and Assiniboine River, were incised through the drift and into the bedrock. Bedrock exposures occur along the sides of these valleys, and several along the Swan River have been measured and described by McNeil and Caldwell (1981). The recorded bedrock surface varies in elevation from 385 m (log number NE84), in the northeast corner of the area, to 557 m (log number NW74) approximately 10 km southwest of Insinger.

The glacial ice eroded but also deposited material, mainly glacial till, which is an unsorted mixture of sand, silt, clay, pebbles, and boulders accumulated by the glacier. As the ice retreated from the area much meltwater was released depositing stratified gravels, sands, silts, and clays. This process of erosion and deposition of till and stratified deposits occurred several times as the ice repeatedly advanced and retreated over the area. This sequence of events resulted in the drift stratigraphy that presently exists.

Where information makes it possible, the drift has been divided into three groups; Empress Group, Sutherland Group, and Saskatoon Group. The Empress Group consists of stratified gravels, sands, silts, and clays that occur between the bedrock surface and the till. The Sutherland Group, as well as the Saskatoon Group, consists of several till units and stratified units that are not formally separated and identified here. The definition of these groups and the description of the typical drift units forming the stratigraphy are provided by Christiansen (1968), Whitaker and Christiansen (1972), and Schreiner (1990).

At some localities the bedrock surface has been modified by the collapse of underlying sediments, similar to that described by Christiansen (1967). These structures are shown on the cross-sections as schematic gravity faults. Another modification of the bedrock surface is exemplified at Howe Lake (22-30-10W2). Here Christiansen et al. (1982) report a hydrodynamic blowout structure.

Bedrock

Marine sediments, deposited in late Cretaceous epeiric seas, dominate the bedrock surface in the Yorkton area. These marine sediments are overlain in some places by relatively extensive deposits of terrestrial deposits that are believed to have been deposited during Tertiary, and perhaps, early Quaternary time. Units that comprise the bedrock surface in the Yorkton area are, in ascending order, the Favel Formation, Morden Shale, Niobrara Formation, Pierre Shale, and undifferentiated Tertiary-Quaternary sediments. Other bedrock units, the Swan River Formation and Ashville Formation are differentiated on the

accompanying cross-sections. However, these units do not occur at the bedrock surface in the Yorkton area. Comprehensive descriptions of the Cretaceous bedrock units found in the Yorkton area are provided by McNeil and Caldwell (1981).

Swan River Formation

The Swan River Formation consisting of locally cemented, fine- to medium-grained sand, silt, and clay, is considered to be the lithostratigraphic equivalent of the Mannville Group of western Saskatchewan. The basal, Jurassic-Cretaceous sands that disconformably overlie Paleozoic sediments have been included in this unit following the practice of Christopher (1984). The Swan River Formation varies in thickness between about 40 m and 145 m.

Ashville Formation

The Ashville Formation, which is composed mainly of noncalcareous dark gray or black silt and clay, is the lithostratigraphic equivalent of the Lower Colorado Group of western Saskatchewan. In the Yorkton area, this unit varies in thickness between about 80 m and 130 m.

Favel Formation

The Favel Formation ranges in thickness from about 10 m to 35 m, and consists of dark gray calcareous shale with thin beds of clayey limestone. This unit is the lithostratigraphic equivalent of the Second White Speckled Shale that

marks the base of the Upper Colorado Group farther west. It forms the bedrock surface over a very limited area in the extreme northeast corner of the Yorkton area.

Morden Shale and Niobrara Formation

The Morden Shale and Niobrara Formation are, for the purposes of the present report, considered as a single unit. Formerly known as the Vermillion River Formation, they are comprised of uniform, black, non-calcareous shale with occasional thin bentonite beds (Morden Shale) and chalky or chalk-speckled shale (Niobrara Formation). The Niobrara Formation is lithostratigraphically equivalent to the First White Speckled Shale further west, however, the Morden Shale, or its equivalent, pinches out to the west (McNeil and Caldwell, 1981). This unit, which forms the bedrock surface over a small area in the northeast corner of the Yorkton area, ranges in thickness from 0 m to about 70 m. At SRC Togo 2 (4-1-27-30W1, log number SE143) syndepositional collapse has caused over thickening of this unit and the underlying Favel Formation.

Pierre Shale

The Pierre Shale is the lithostratigraphic equivalent of the Bearpaw, Judith River, and Lea Park formations, which occur further west in Saskatchewan. The noncalcareous silts and clays that comprise this unit are indistinguishable from those of the Bearpaw and Lea Park formations. The Pierre Shale occurs

throughout the Yorkton area except the extreme northeast corner. It ranges in recorded thickness from 0 m to about 210 m.

Undifferentiated Tertiary-Quaternary Sediments

The youngest bedrock deposits encountered in the Yorkton area consist of a fining upward sequence of yellow, gray, or white sand, silt, and clay, with local gravelly zones at the base. These sediments, which have been informally designated as the "Wynyard Formation" (Christiansen, 1970) and the "Bredenbury Formation" (Christiansen, 1981), occur as erosional remnants of the Tertiary to earliest Quaternary bedrock. Well preserved, soft, unlithified wood is reported to be common throughout this unit (Schreiner and Maathuis, 1982).

These sediments attain a maximum recorded thickness near Howe Lake where the sequence consists of approximately 4 m of chert and quartzite gravel overlain by 7 m fine- to medium-grained sand, which is in turn overlain by approximately 80 m of calcareous silt (composite of logs NW85 and NW86). Further to the southeast, in the Willowbrook-Yorkton-Saltcoats areas, sand becomes the dominant sediment and the deposits are much thinner.

Drift

Empress Group

Where it is differentiated, the Empress Group (Whitaker and Christiansen, 1972) lies between the bedrock surface and the lowest till. These sediments have been differentiated from the Tertiary-Quaternary bedrock primarily on the basis

of lower elevation and the presence of shield and carbonate clasts that reflect the northern or northeastern provenance of the Empress Group. In the Yorkton area the Empress Group sediments, comprising stratified gravels, sands, silts, and clays, occur as blanket deposits in upland areas, particularly in the vicinity of Yorkton, and as buried valley deposits, particularly around McNutt. The maximum recorded thickness of the Empress Group (67 m) is found northeast of Saltcoats (NE14-24-1W1) where it appears that glacial ice eroded an oblong depression into the bedrock that was later filled with stratified sediments.

Sutherland Group

Where it is differentiated, the Sutherland Group (Christiansen, 1968) lies beneath the Saskatoon Group and on top of bedrock or Empress Group deposits. In many places, particularly where the drift is thin, the Sutherland Group is absent, having been eroded during subsequent glacial episodes. The unit ranges from 0 to about 170 m in recorded thickness and comprises three tills and associated stratified units. The upper and lower tills of the Sutherland Group are commonly clayier and harder, less resistive electrically, and are more difficult to penetrate by drilling than tills of the Saskatoon Group. However, the middle till is often similar to the lower till of the Floral Formation. These two groups are also differentiated on the basis of carbonate content, the presence of shale fragments in the till, and a weathering zone separating the two groups. The weathering is signified by leaching, oxidation, staining, and other alteration

features. At some locations the top of the Sutherland Group is marked by stratified drift.

Saskatoon Group

The Saskatoon Group (Christiansen, 1968) includes all sediments lying between the Sutherland Group and the present surface. In the Yorkton area this unit ranges from 2 m to about 110 m in recorded thickness and is composed of tills and stratified drift. The tills of the Saskatoon Group are commonly more sandy, more resistive electrically, and have a higher carbonate content than the Sutherland Group tills. The Saskatoon Group comprises the Floral Formation, which itself consists of multiple tills and stratified units, as well as the Battleford Formation and Surficial Stratified Drift (Christiansen, 1968).

Surficial Stratified Drift occurs as glaciolacustrine and glaciofluvial sediments and as alluvial sediments that were deposited by modern streams and rivers, or in spillways that drained ice-marginal lakes. The Assiniboine Spillway (Christiansen, 1979) is an example of a spillway in which glaciofluvial sediments were deposited. Surficial sands in the Whitesand River Valley were deposited in an ice-walled channel during the deglaciation of the area (Cherry, 1966).

GROUNDWATER RESOURCES

General

Groundwater originates from precipitation that infiltrates to the water table, moves downward and laterally under the influence of gravity, and eventually

discharges back to the ground surface at some point of lower elevation (Meneley, 1977).

An aquifer is a layer in which a well can be constructed yielding sufficient water for production. Aquifers are separated by aquitards, which are layers sufficiently permeable to transmit water but not sufficiently permeable to allow completion of a production well. The inter-relationships between aquifer, aquitards, and aquifer systems are discussed by Meneley (1983).

Groundwater moves through the intergranular openings and fractures in the sediments. The hydraulic head generally is expressed as the elevation above sea level of the water level in a well. If the layers are horizontal and of large areal extent, as in this area, the water tends to move vertically in aquitards while in aquifers it moves horizontally. The distribution of the hydraulic head determines the direction of flow. The hydraulic head distribution in turn is controlled by factors such as topography, stratigraphical setting, and the type of material forming the aquitards and aquifers.

The Swan River Formation is the most extensive and important aquifer in the Yorkton area as it provides the driving mechanism for the entire groundwater regime. However, as it is not known to be exploited for domestic use, it will not be further discussed. The Tertiary-Quaternary bedrock, Empress Group and intertill sands and gravels form the major, exploited aquifers in the Yorkton area. Till units and bedrock clays form the aquitards in the area.

For a more detailed evaluation of the groundwater resources in and around the City of Yorkton than is presented here, the reader is referred to Maathuis (1991).

Surficial Aquifers

Many shallow seepage wells, generally less than 15 m deep, have been constructed throughout the area. These have been completed primarily in Surficial Stratified Drift and in stratified deposits of the Battleford Formation. Surficial aquifers (Sheet 1 and cross-sections) are few and rather small in area.

Intertill Aquifers

Intertill aquifers are defined stratigraphically rather than topographically. Thus, in some areas the depth of the same intertill aquifer can vary from relatively shallow to deep. Where intertill aquifers are reasonably well defined they are shown on the cross-sections. Where these stratified deposits are interbedded with till, or where insufficient data exist, the aquifers are not shown.

Intertill aquifers are recharged by downward flow through the overlying sediments. Where possible, using limited water-level data and based on the topography, the direction of groundwater flow in these aquifers has been indicated schematically on the cross-sections. In the absence of sufficient, reliable water-level data the direction of groundwater flow in the shallow intertill aquifers can only be inferred from the topographical setting.

In the Yorkton area, intertill aquifers occur at three stratigraphic positions; between tills of the Floral Formation (Sheet 1), between the lowest till of the Saskatoon Group and the highest till of the Sutherland Group (Sheet 2), and between the tills of the Sutherland Group (Sheet 3). Recorded depths to the top of the intertill sand in the Floral Formation are commonly less than 25 m.

The stratified deposits that form the 'interglacial' aquifers (Sheet 2) are believed to occur between the lowest till of the Saskatoon Group and the highest till of the Sutherland Group. Depths to the top of these deposits ranges from 3 m to 77 m. These deposits are rather extensive and quite numerous throughout all but the northeastern portion of the Yorkton area.

Two major occurrences of Sutherland Group intertill deposits, and several smaller ones, have been delineated on Sheet 3 and on the cross-sections. These deposits are more extensive although less numerous, than are the 'interglacial' aquifers. One of these aquifers, located in the northwest, and extending off the map area to the north and west, is recharged in the upland area north of Invermay and Margo, and discharges into the Quill Lakes Basin. The other, which is found in the southwest, is recharged in the Beaver Hills near Jasmin. From this divide, the groundwater flows northwesterly, and also easterly where the aquifer is partially drained by underlying Tertiary-Quaternary sediments in the Willowbrook-Jedburgh area.

Empress Group and Tertiary-Quaternary Bedrock Aquifers

Aquifers that are comprised of sediments of the Empress Group and the Tertiary-Quaternary bedrock (Sheet 4) cover rather extensive areas in the southern and western parts of the Yorkton area. In the south, where these deposits are part of a complex aquifer system, the aquifers have been delineated and named by Schreiner and Maathuis (1982).

An extensive blanket deposit of Empress Group sediments forms an extension of the Melville Aquifer (Schreiner and Maathuis, 1982) in the southwest part of the Yorkton area. Depths to the top of this aquifer range from 138 m to 207 m and recorded thickness varies from 10 m to 50 m. Further east, southwest of McKim extensions of this aquifer, as mapped by Schreiner and Maathuis (1982), are in contact with Tertiary-Quaternary sediments that comprise the Bredenbury Aquifer and the Willowbrook Aquifer, thus providing hydraulic continuity. Depths to the top of the Tertiary-Quaternary sediments that constitute the Bredenbury and Willowbrook aquifers range from 2 m to 50 m and 29 m to 149 m respectively.

An extension of the Hatfield Valley Aquifer occurs in the buried valley in the extreme southeastern corner of the map area. North of Calder, the sediments that constitute this aquifer are believed to be in direct contact with those that constitute the Bredenbury Aquifer. The depth to the top of these Empress Group sediments varies between 46 m and 82 m while the thickness ranges from 5 m to 31 m.

While these aquifers are drained primarily by the Hatfield Valley Aquifer farther south (Schreiner and Maathuis, 1982), there are local variations in the groundwater flow direction as evidenced by the piezometric elevations.

The complex system of aquifers that occurs in the southern part of the Yorkton area at this stratigraphic horizon; between the Cretaceous clays (Pierre Shale) and the till; have been demonstrated to be interconnected (Schreiner and Maathuis, 1982). Recharge is primarily in the west, in the Touchwood Hills Upland (i.e. the Beaver Hills), although some recharge probably occurs farther east near Yorkton and Wroxton, where the aquifers occur very close to the surface. While the Hatfield Valley Aquifer receives flow from these aquifers, valleys that are incised into or through them, particularly Cutarm Creek and the Assiniboine River, which cut the Bredenbury Aquifer, receive discharge. Other areas of discharge, as indicated by the presence of flowing wells include the Saltcoats area, the topographic-low area south of Yorkton, and the Willowbrook area.

In the northwest part of the Yorkton area Empress Group sediments occur around Hazel Dell and in an area that extends from Silver Lake, southeast of Margo, northwest through Kuroki almost to Wadena. This latter aquifer occurs at depths between 64 m and 110 m and varies between 3 m and 71 m in thickness.

Tertiary-Quaternary bedrock sediments extend from near Insinger northwest to Foam Lake. Near Insinger, the aquifer is about 8 m thick and 120 m deep. Near Foam Lake the aquifer is about 5 m thick and 75 m deep.

Flowing Wells

Flowing wells, where the water level is above the ground surface, generally indicate an upward groundwater flow. Flowing wells have been completed into deep intertill as well as Tertiary-Quaternary and Empress Group aquifers. Flowing conditions are concentrated in, but not restricted to, three regions of the Yorkton area; the Foam Lake - Invermay region in the northwest, near Willowbrook, and near Saltcoats. Appendix II lists the flowing wells for the Yorkton area, including those compiled by Stewart (1983). The completion depth of the well and the classification and the stratigraphic position of the aquifer (if known) are also included.

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APPENDIX I

Aquifers in the Yorkton Area (62M, N)

Surficial Aquifers - occur sporadically throughout the area as stratified drift within and above the Battleford Formation.

Shallow Intertill Aquifers - occur throughout the area as sand and gravel layers in the upper part of the Floral Formation. Depths are commonly less than 25 m.

Deep Intertill Aquifers - occur throughout the area as sand and gravel layers in the lower part of the Saskatoon Group and within the Sutherland Group. These are more numerous and extensive than those associated with the upper part of the Floral Formation.

Empress Group and Tertiary-Quaternary Bedrock Aquifers - occur throughout the southern and western portions of the Yorkton area, where they are perhaps the most important sources of domestic water use. In the southern part of the Yorkton area these aquifers are part of the Hatfield Valley Aquifer system.

Aquitards - occur throughout the area as relatively impermeable till layers of the Saskatoon and Sutherland Groups and bedrock silts and clays.

APPENDIX II

Flowing Wells in the Yorkton Area (62M, N)

Location	Aquifer Classification/ Stratigraphic Position	Completion Depth
SE34-23-30W1	Buried Valley/Empress Group	68 m
SW35-29-30W1	Intertill/Sutherland Group	66 m
MW10-35-30W1	Surficial?	8 m
NE28-24-31W1	Intertill?/Basal Floral	29 m
NE31-27-31W1	Blanket/Tertiary-Quaternary	15 m
NE28-29-31W1	Intertill/Upper Floral	10 m
NW24-29-33W1	Surficial?	≤7 m
NE1-29-1W2	no data	
NE4-29-1W2	no data	
SW25-23-2W2	Bedrock/Tertiary-Quaternary	
SW34-23-2W2	Buried Valley/Empress Group	58 m
NE35-23-2W2	Bedrock/Tertiary-Quaternary	25 m
NE3-24-2W2	Bedrock/Tertiary-Quaternary	27 m
SW10-24-2W2	Bedrock/Tertiary-Quaternary	26 m
SW15-24-2W2	Bedrock/Tertiary-Quaternary	42 m
SE16-24-2W2	Bedrock/Tertiary-Quaternary	
NE23-24-3W2	Intertill/Basal Floral	4-23 m
SW7-25-4W2	Bedrock/Tertiary-Quaternary	22 m
NW3-25-5W2	Bedrock/Tertiary-Quaternary	6-9 m
SW10-25-5W2	Till?	≤14 m
NW10-25-5W2	Bedrock/Tertiary-Quaternary	25 m
NE10-25-5W2	Intertill/Sutherland Group	10-14 m?
SW13-25-5W2	Bedrock/Tertiary-Quaternary	23 m
SW14-25-5W2	Bedrock/Tertiary-Quaternary	26 m
SW15-25-5W2	Bedrock/Tertiary-Quaternary	14 m
SE16-25-5W2	Bedrock/Tertiary-Quaternary	15 m
SW16-25-5W2	Intertill/Sutherland Group	20 m
SE17-25-5W2	Intertill/Sutherland Group	30 m
SE30-24-6W2	Bedrock/Tertiary-Quaternary	?
NW31-24-6W2	Bedrock/Tertiary-Quaternary	75 m
SW32-24-6W2	no data	
SW33-24-6W2	Bedrock/Tertiary-Quaternary	66 m
SE2-25-6W2	Buried Valley/Empress?	79 m
NE4-25-6W2	Bedrock/Tertiary-Quaternary?	?
SW4-25-6W2	Bedrock/Tertiary-Quaternary	47 m
NE8-25-6W2	no data	
NW9-25-6W2	Bedrock/Tertiary-Quaternary	27 m
SE18-25-6W2	Bedrock/Tertiary-Quaternary	51 m
SW18-25-6W2	Intertill/Basal Floral?	41 m
NE26-24-7W2	Bedrock/Tertiary-Quaternary	91 m
SE2-25-7W2	no data	

Location	Aquifer Classification/ Stratigraphic Position	Completion Depth
NW13-25-7W2	Bedrock/Tertiary-Quaternary	62 m
NW20-25-7W2	Bedrock/Tertiary-Quaternary	91 m
NE21-25-7W2	Bedrock/Tertiary-Quaternary	83 m
NE25-25-8W2	Bedrock/Tertiary-Quaternary	101 m
NW8-29-8W2	Intertill/Basal Floral?	34 m
NW19-33-8W2	Intertill/Sutherland Group	87 m
SW22-33-8W2	Intertill/Basal Floral	28 m
SE3-29-9W2	Bedrock/Tertiary-Quaternary	120 m
NW3-29-9W2	Bedrock/Tertiary-Quaternary	123 m
SE4-29-9W2	Bedrock/Tertiary-Quaternary	125 m
NE4-29-9W2	Bedrock/Tertiary-Quaternary	124 m
SE25-29-9W2	Bedrock/Tertiary-Quaternary	75 m
SE28-29-9W2	Bedrock/Tertiary-Quaternary	70-75 m
SE5-30-9W2	Intertill/Upper Floral	30 m
SE30-30-9W2	Bedrock/Tertiary-Quaternary	92 m
NW15-31-9W2	Intertill/Sutherland Group	59 m
NW22-31-9W2	Blanket/Empress Group	96 m
NE27-31-9W2	Till/Sutherland Group	65 m
SE11-32-9W2	Intertill/Basal Floral	18 m
NW14-32-9W2	no data	
NW16-32-9W2	Blanket/Empress Group	69 m
NE20-32-9W2	Intertill/Basal Floral	45 m
SW22-32-9W2	Intertill/Upper Floral	8 m
SW31-32-9W2	Intertill/Basal Floral	23 m
NE10-33-9W2	Intertill/Basal Floral	57 m
NW12-33-9W2	no data	
NW23-33-9W2	no data	
NW24-33-9W2	Intertill/Basal Floral	34 m
SE26-33-9W2	Intertill/Basal Floral	34 m
SE35-33-9W2	Intertill/Sutherland Group	68 m
SW36-33-9W2	Intertill/Sutherland Group	62 m
SE17-34-9W2	Intertill/Basal Floral	22 m
NW18-34-9W2	no data	
NW19-34-9W2	Intertill/Basal Floral	36 m
SW20-34-9W2	Intertill/Basal Floral	36 m
SW33-30-10W2	Bedrock/Tertiary-Quaternary	76 m
NE16-31-10W2	Intertill/Sutherland Group	74 m
SW20-31-10W2	Intertill/Sutherland Group	75 m
SE30-31-10W2	Intertill/Sutherland Group	72 m
NW30-31-10W2	Intertill/Sutherland Group	70 m
NE5-32-10W2	Intertill/Sutherland Group	55 m

Location	Aquifer Classification/ Stratigraphic Position	Completion Depth
NE11-32-10W2	Intertill/Sutherland Group	44 m
NW7-32-10W2	Intertill/Sutherland Group	53 m
SE17-32-10W2	Intertill/Sutherland Group	45 m
NE28-32-10W2	Intertill/Basal Floral	37 m
SE29-32-10W2	Intertill/Basal Floral	29 m
SE35-32-10W2	Intertill/Basal Floral	22 m
NW36-32-10W2	Intertill/Basal Floral	22 m
NE6-33-10W2	Intertill/Basal Floral	32 m
NW7-33-10W2	Intertill/Sutherland Group	66 m
NW32-33-10W2	Blanket/Empress Group	69 m
NE13-34-10W2	no data	
NE27-34-10W2	Intertill/Upper Floral	20 m
NE28-34-10W2	Intertill/Upper Floral	16 m
NW31-30-11W2	Bedrock/Tertiary-Quaternary	80 m
NW33-30-11W2	Bedrock/Tertiary-Quaternary	82 m
Center 13-31-11W2	Intertill/Upper Floral?	41 m
SE14-31-11W2	Bedrock/Tertiary-Quaternary	81 m
NW16-31-11W2	Bedrock/Tertiary-Quaternary	78 m
SE25-31-11W2	Bedrock/Tertiary-Quaternary	69 m
SE36-31-11W2	Bedrock/Tertiary-Quaternary	67 m
SE1-32-11W2	Intertill/Sutherland Group	60 m
SW2-32-11W2	Intertill/Sutherland Group	56 m
NW2-33-11W2	Blanket/Empress Group	88 m
NW7-33-11W2	Intertill/Sutherland Group	76 m
NW12-33-11W2	Intertill/Sutherland Group	66 m
SW9-34-11W2	Intertill/Upper Floral	25 m
SE36-29-12W2	Intertill/Upper Floral	20 m
NE1-30-12W2	Intertill/Basal Floral	41 m
SE12-30-12W2	Intertill/Basal Floral	29 m
NW12-30-12W2	Bedrock/Tertiary-Quaternary	116 m
NE24-30-12W2	Bedrock/Tertiary-Quaternary	90 m
SW31-31-12W2	Intertill/Upper Floral?	21 m
SE5-32-12W2	Intertill/Sutherland Group	73 m
SW18-32-12W2	Intertill/Basal Floral	43 m
SW27-32-12W2	Intertill/Basal Floral	39 m
NW7-30-13W2	Intertill?/Upper Floral	8 m
SE24-31-13W2	Blanket/Empress Group	107 m
SE25-31-13W2	Intertill/Basal Floral?	39 m
Centre 36-31-13W2	Intertill/?	54 m
NW4-34-13W2	Intertill/Upper Floral	17 m
SW14-34-13W2	Intertill/Upper Floral	25 m

Location	Aquifer Classification/ Stratigraphic Position	Completion Depth
NE9-29-14W2	Intertill/Upper Floral?	19 m
SW16-29-14W2	Intertill/Upper Floral?	27 m
SE3-33-14W2	Intertill/Basal Floral	65 m
NE28-34-14W2	no data	
NW10-35-14W2	Intertill/Basal Floral	62 m
NE3-35-14W2	Intertill/Basal Floral	70 m

APPENDIX III

Index of Cross-Section Logs

The following types of logs and records have been used for the compilation of this work.

1. The SRC file contains logs that include E-logs, driller's logs, geologist's description of the cutting samples, and often analytical results. These logs are listed as SRC, HDC, DMR-SRC-U of S, GSC, DTRR, IWS, PRFA, HALL, and SRC/DOE.
2. The Oil - Potash logs consists of geophysical logs only. These logs are listed as Oil.
3. The SWC file contains logs consisting of E-logs, driller's logs, and information pertaining to well completion. Collection of this type of data was administered by the SWC. These logs are listed as SWC.
4. Records including driller's logs and information pertaining to well completion are listed as DOE.

62M, N YORKTON

NW Log No.	Log Type/Name	Land Location
1	SWC	NW32-34-14W2
2	SWC	NE3-35-14W2
3	SWC	SW5-35-13W2
4	SRC Wadena 3	SE3-3-35-13W2
5	SRC Wadena	NW2-6-35-12W2
6	SWC	NW31-34-11W2
7	SWC	SW2-35-11W2
8	SWC	NW32-34-10W2
9	SRC Margo	NW5-34-34-10W2
10	SWC	8-34-34-10W2
11	SWC	SW5-35-9W2
12	SWC	13-33-34-9W2
13	SWC	SE26-34-9W2
14	SWC	SE21-34-8W2
15	SWC	SE36-32-15W2
16	SRC Mozart	SW4-15-33-14W2
17	SRC Wadena	SE9-5-34-13W2
18	SWC	SW4-34-13W2
19	SWC	16-27-33-13W2
20	SWC	13-23-33-13W2
21	SWC	13-6-33-12W2
22	SWC	2-10-33-12W2
23	SWC	14-2-33-12W2
24	SWC	NE14-6-33-11W2
25	SWC	NE3-33-11W2
26	SWC	NW2-33-11W2
27	SWC	SE5-33-10W2
28	Oil Can Gulf Margo STH 23	4-6-33-9W2
29	SRC Invermay	NE1-2-33-9W2
30	Oil Sohio Invermay	5-6-33-8W2
31	SWC	SE4-33-8W2
32	Oil Can Gulf Margo STH 24	13-36-32-8W2
33	SWC	SW30-30-14W2
34	SRC Leslie	NE14-34-30-13W2
35	SWC	NE32-30-12W2
36	SWC	NW16-31-12W2
37	SWC	11-16-31-11W2
38	SWC	NE22-31-11W2
39	HDC Foam Lake	SE5-14-31-11W2

NW Log No.	Log Type/Name	Land Location
40	SWC	16-33-30-10W2
41	Oil Bailey Selburn Foam Lake	1-14-31-10W2
42	SWC	13-22-31-9W2
43	SWC	NW25-31-9W2
44	SWC	SW4-32-8W2
45	Oil Can Gulf Margo STH 2	2-32-8W2
46	SRC Wishart	SW1-20-29-14W2
47	SWC	SE14-29-14W2
48	Oil Tidewater Edmore Crosn STH 1	13-20-29-12W2
49	SWC	NE12-29-12W2
50	SWC	NE21-29-11W2
51	SWC	NW10-29-10W2
52	HDC Sheho	SW32-29-9W2
53	SRC Insinger	SW2-24-29-9W2
54	SWC	13-18-29-8W2
55	SWC	SE19-29-8W2
56	SWC	SW28-29-14W2
57	SWC	NE33-29-14W2
58	SWC	1-20-30-13W2
59	Oil Tidewater Wishart Crosn STH 1	13-21-30-13W2
60	SWC	14-12-32-14W2
61	SWC	SW13-32-14W2
62	SWC	14-14-32-14W2
63	SWC	1-3-33-14W2
64	SWC	13-22-34-14W2
65	SWC	1-33-34-14W2
66	SWC	6-10-35-14W2
67	SWC	SW1-33-29-12W2
68	SWC	SW3-4-30-12W2
69	SWC	NE14-12-30-12W2
70	SWC	NW8-23-30-12W2
71	SWC	16-24-30-12W2
72	SWC	SE1-36-30-12W2
73	SWC	2-5-32-11W2
74	SWC	NE6-32-11W2
75	SWC	SE2-16-32-12W2
76	SWC	SW12-16-32-12W2
77	SWC	SW4-27-32-12W2
78	SWC	SE9-3-33-12W2
79	SWC	NW13-12-33-12W2
80	SWC	NE32-33-11W2

NW Log No.	Log Type/Name	Land Location
81	SWC	SW4-28-34-12W2
82	SWC	SE16-25-34-13W2
83	SWC	SE8-35-12W2
84	Oil Arco Foam Lake	4-6-30-10W2
85	HDC Tuffnell	NW10-30-10W2
86	SRC Tuffnell	NE3-22-30-10W2
87	SRC Tuffnell	SW7-22-30-10W2
88	SWC	SW35-30-10W2
89	SWC	SW20-31-10W2
90	SWC	1-30-31-10W2
91	SWC	SE36-31-11W2
92	SWC	SE1-32-11W2
93	Oil Can Gulf Margo	9-6-32-10W2
94	SWC	NW7-32-10W2
95	SRC Layco	SE4-13-32-11W2
96	Oil Margo #22	29-32-10W2
97	SWC	14-7-33-10W2
98	SWC	11-16-33-10W2
99	SWC	NE21-33-10W2
100	SWC	13-8-34-10W2
101	SRC Central Kuroki	1-30-34-10W2
102	Oil Imperial Kuroki	7-30-34-10W2
103	SWC	SW3-35-10W2
104	SWC	NW12-35-10W2
105	Oil Sohio Allenbee Sth Lintlaw	4-15-35-10W2
106	Oil PCA Insinger	1-14-29-9W2
107	SWC	2-25-29-9W2
108	SWC	1-2-30-9W2
109	SWC	3-9-30-9W2
110	HDC Sheho	NE9-30-9W2
111	SWC	SW26-30-9W2
112	SWC	SW35-30-9W2
113	Oil Sohio Sheho	5-14-31-9W2
114	SWC	NE27-31-9W2
115	Oil Bailey Selburn Foam Lake	1-34-31-9W2
116	SWC	SW33-31-9W2
117	SWC	NW33-31-9W2
118	SWC	12-16-32-9W2
119	SWC	15-21-32-9W2
120	Oil Can Gulf Margo STH 20	4-36-32-9W2
121	Oil Can Gulf Margo STH 27	13-36-32-9W2

NW Log No.	Log Type/Name	Land Location
122	SWC	NW2-33-9W2
123	Oil Can Gulf Margo	8-11-33-9W2
124	Oil Can Gulf Margo STH 9	12-12-33-9W2
125	Oil Can Gulf Margo STH 10	12-13-33-9W2
126	SWC	1-26-33-9W2
127	Oil Can Gulf Margo STH 12	SE1-26-33-9W2
128	SWC	SW36-33-9W2
129	SWC	4-24-34-9W2
130	Oil Sohio Okla	1-5-35-8W2

NE Log No.	Log Type/Name	Land Location
1	SWC	SW23-34-7W2
2	Oil Can Gulf Buchanan STH 25	13-29-34-6W2
3	SWC	3-28-34-6W2
4	SWC	15-35-34-6W2
5	SWC	SE32-34-5W2
6	SWC	NE27-34-5W2
7	SWC	SE32-34-4W2
8	DMR-SRC-U of S Stenen SHT 33	NW14-11-34-4W2
9	DMR-SRC-U of S Stenen SHT 16	NW15-32-33-3W2
10	DMR-SRC-U of S Stenen SHT 15	NW16-32-33-3W2
11	SWC	4-6-34-1W2
12	SWC	16-7-34-1W2
13	SWC	NW9-34-1W2
14	SRC Pelly	NE1-9-35-32-1W2
15	Oil Husky Little Woody STH 1	4-5-35-31W1
16	Oil Woodly Ada Thunderhill	4A-5-35-31W1
17	SRC Arran	16-35-34-31W1
18	Oil Shell STH 86	13-23-34-30W1
19	GSC Good Spirit Lake	SE1-3-32-7W2
20	GSC Good Spirit Lake	NW13-33-31-6W2
21	SWC	NE34-31-6W2
22	SWC	2-2-32-6W2
23	GSC Good Spirit Lake	NW13-31-31-5W2
24	Oil Can Gulf Buchanan STH 6	16-31-31-5W2
25	SWC	NW34-31-5W2
26	SWC	SE14-32-5W2
27	SWC	SE18-32-4W2
28	SRC Canora	NW5-27-31-3W2
29	SWC	10-25-31-3W2
30	SRC Key	SE14-19-31-1W2
31	SWC	13-19-29-7W2
32	SWC	SW26-29-7W2
33	Oil Sohio Drobot	15-22-29-6W2
34	SRC Good Spirit Lake	NE15-35-29-6W2
35	SRC Good Spirit Lake	NW13-26-29-5W2
36	SWC	1-26-29-5W2
37	SWC	NE24-29-5W2
38	SWC	NW13-29-4W2
39	SWC	NE10-29-2W2
40	DOE	SE14-29-1W2
41	Oil Nor Gas Northern 4 Kamsack	16-15-29-32W1

NE Log No.	Log Type/Name	Land Location
42	DOE	SE24-29-32W1
43	SWC	16-21-29-31W1
44	Oil Sohio Insinger	16-29-7W2
45	SWC	1-2-30-7W2
46	SWC	NE10-30-7W2
47	SWC	SW16-30-7W2
48	SRC Rama	SW4-30-31-7W2
49	Oil Can Gulf Buchanan STH 39	16-7-32-6W2
50	Oil Can Gulf Buchanan STH 32	16-28-32-6W2
51	SWC	1-34-32-6W2
52	Oil Sohio STH Buchanan 1	13-35-32-6W2
53	Oil Can Gulf Buchanan STH 12	4-9-33-6W2
54	Oil Can Gulf Buchanan STH 13	4-21-33-6W2
55	Oil Can Gulf Buchanan STH 14	4-32-33-6W2
56	Oil Sohio Parkview STH 1	4-6-34-6W2
57	Oil Can Gulf Buchanan STH 37	4-13-34-7W2
58	Oil Can Gulf Buchanan STH 24	13-14-34-7W2
59	SWC	4-23-34-7W2
60	SWC	8-10-30-5W2
61	DMR-SRC-U of S Good Spirit Lake	NE16-9-30-5W2
62	Oil Sohio Devil's Lake STH 1	16-9-30-5W2
63	SRC Good Spirit Lake	SW4-30-30-5W2
64	Oil Can Gulf Buchanan STH 26	13-5-32-5W2
65	SWC	SW20-32-5W2
66	Oil Can Gulf Buchanan STH 29	4-28-32-5W2
67	SWC	13-25-32-5W2
68	SWC	SW8-33-4W2
69	SWC	2-16-35-4W2
70	SWC	16-23-30-4W2
71	SWC	1-14-32-3W2
72	PFRA RD64	NW11-32-32-3W2
73	PFRA RD65	NE14-32-32-3W2
74	PFRA RD66	SE1-6-33-3W2
75	PFRA RD67	SE2-6-33-3W2
76	SRC Stenen	SE16-7-33-3W2
77	Oil Can Reserves Stenen STH 1	11-31-34-3W2
78	SWC	SW14-30-2W2
79	SRC Norquay	NW1-20-33-1W2
80	SWC	9-31-33-1W2
81	SRC Madge Lake	NE15-27-30-30W1
82	DTRR Madge Lake	16-17-31-30W1

NE Log No.	Log Type/Name	Land Location
83	SRC Dell Lake	SE1-3-33-30W1
84	Oil Imperial Whitebeach	1-10-35-30W1

SW Log No.	Log Type/Name	Land Location
1	SWC	SW7-27-14W2
2	SWC	SE10-27-14W2
3	SWC	SE1-27-14W2
4	SWC	SW17-27-13W2
5	SRC Ladstock	NW16-25-27-13W2
6	Oil Tidewater Beckenham Crown STH 1	4-13-27-11W2
7	SWC	13-5-27-8W2
8	SWC	NE5-27-8W2
9	SWC	NW3-27-8W2
10	SWC	NE3-26-14W2
11	SWC	14-7-26-13W2
12	SWC	11-8-26-13W2
13	SWC	SE9-26-13W2
14	SWC	NW10-26-13W2
15	SWC	13-20-25-12W2
16	Oil Tidewater Ituna Crown 4	1-29-25-12W2
17	SWC	16-5-26-11W2
18	SWC	NW2-26-11W2
19	SWC	16-29-25-10W2
20	SWC	13-33-25-9W2
21	SWC	SE35-25-9W2
22	SWC	3-5-26-8W2
23	SWC	3-15-26-8W2
24	SWC	3-25-24-15W2
25	Oil Tidewater Headlands Crown	4-34-24-14W2
26	SWC	NE22-24-14W2
27	SWC	NW24-24-14W2
28	SWC	NW19-24-13W2
29	SWC	SE30-24-13W2
30	SWC	3-27-24-13W2
31	SWC	14-7-24-12W2
32	SWC	NW9-24-12W2
33	SWC	10-9-24-12W2
34	SWC	NW10-24-12-W2
35	SWC	3-6-24-11W2
36	SWC	SW10-24-10W2
37	SWC	4-1-24-10W2
38	SRC Goodeve	SW6-10-24-9W2
39	SWC	SW18-24-8W2
40	SWC	12-12-25-15W2
41	SWC	SE32-25-14W2

SW Log No.	Log Type/Name	Land Location
42	SWC	15-22-26-14W2
43	SRC Leross	SE1-27-26-14W2
44	SWC	4-6-27-14W2
45	SWC	NE19-27-14W2
46	SRC Wynot	NE16-4-28-14W2
47	Oil Tidewater Wynot Crown STH 1	16-18-28-14W2
48	SWC	NE13-20-28-14W2
49	SWC	SW5-24-13-W2
50	SWC	SE5-16-24-13W2
51	SWC	SW5-32-24-13W2
52	SWC	NE4-25-13W2
53	SWC	NE13-14-25-13W2
54	SWC	SW4-27-25-13W2
55	SWC	SW3-26-13W2
56	SWC	NW16-27-26-13W2
57	SWC	NE13-36-26-13W2
58	SWC	SE12-24-12W2
59	SWC	NE12-25-12W2
60	Oil Tidewater Ituna Crown STH 2	4-32-25-11W2
61	Oil Tidewater Ituna Crown STH 3	16-10-26-11W2
62	Oil Tidewater Flint West Bend Cr STH 1	13-22-28-11W2
63	SWC	4-2-29-11W2
64	SWC	NW34-24-9W2
65	SWC	SE7-25-9W2
66	Oil Tidewater Beaver Hill Cr	1-5-26-9W2
67	SWC	NE7-26-9W2
68	SWC	16-18-26-9W2
69	SWC	14-27-26-9W2
70	Oil Phillips Fitzmaurice	16-18-27-8W2
71	SWC	2-7-28-9W2
72	Oil Shell Insinger	11-11-28-9W2
73	HDC Sheho	SE4-29-9W2
74	HDC Sheho	NE4-29-9W2

SE Log No.	Log Type/Name	Land Location
1	SWC	8-17-27-7W2
2	SWC	SE22-27-7W2
3	SWC	4-19-27-6W2
4	SWC	16-18-27-6W2
5	SWC	14-17-27-6W2
6	SWC	NW14-27-6W2
7	Oil Seaboard Devil's Lake Crown	13-16-27-5W2
8	SWC	16-21-27-4W2
9	Oil Sohio Edenezer 1	4-32-27-3W2
10	Oil Sohio Rhein 1	4-32-27-2W2
11	SWC	15-11-27-2W2
12	SWC	14-30-27-32W1
13	Oil Charter Stornoway	4-28-27-32W1
14	SWC	12-24-27-32W1
15	SRC Togo	NE4-33-27-30W1
16	SWC	14-26-27-30W1
17	SWC	NE16-26-7W2
18	SWC	3-22-26-7W2
19	Oil Amerada SB	2-29-26-6W2
20	SWC	8-28-26-6W2
21	Oil Amerada Cr Sc	5-11-26-6W2
22	SWC	13-2-26-6W2
23	SWC	13-31-25-5W2
24	SWC	14-33-25-5W2
25	SRC/DOE Yorkton 512	SW4-2-26-5W2
26	SWC	3-2-26-5W2
27	IWS Yorkton 65-022	NW13-31-25-4W2
28	IWS Yorkton 65-009	NW1-6-26-4W2
29	IWS Yorkton Well 007	SE3-4-26-4W2
30	IWS Yorkton Well 004	SW4-3-26-4W2
31	SRC/DOE Yorkton 510	SW12-12-26-4W2
32	IWS Yorkton 66-002	NW16-1-26-4W2
33	SWC	1-1-26-3W2
34	SWC	13-28-25-2W2
35	DOE	NW24-25-2W2
36	SRC Barvas	SW4-22-25-1W2
37	DOE	NE24-25-1W2
38	SWC	3-30-25-32W1
39	SWC	SW32-25-31W1
40	Oil Rio Tinto STH 8	16-33-25-31W1
41	Oil Amerada Crown S-AK	5-29-25-30W1

SE Log No.	Log Type/Name	Land Location
42	DOE	SW29-25-30W1
43	SWC	NW16-24-7W2
44	SRC Willowbrook	SE16-29-24-6W2
45	SWC	SW33-24-6W2
46	SWC	SW26-24-6W2
47	SWC	7-20-24-5W2
48	Oil Sohio Otthon STH 1	13-24-24-5W2
49	IWS Yorkton 67-001	SE1-29-24-4W2
50	IWS Yorkton 67-002	NW8-28-24-4W2
51	SRC/DOE Yorkton 501	SE9-27-24-4W2
52	SWC	16-26-24-4W2
53	IWS Yorkton 66-013	NW13-25-24-4W2
54	Oil Duval Yorkton	13-10-24-3W2
55	Oil Trans Era STH 9	1-2-24-3W2
56	SRC/DOE Yorkton 529	SE1-1-24-3W2
57	SRC Saltcoats	SW1-4-24-2W2
58	SRC/DOE Yorkton 530	SW3-1-24-2W2
59	SRC Saltcoats 2	SE2-9-24-1W2
60	SRC Calder	NE9-9-24-32W1
61	SWC	1-19-24-31W1
62	Oil Amerada Crown S-AH	16-22-24-31W1
63	Oil BA Oil Birmingham	7-29-23-7W2
64	SWC	3-9-24-7W2
65	SWC	4-33-24-7W2
66	Oil BA Oil Plain View	2-4-25-7W2
67	SWC	SW16-25-7W2
68	SWC	NE21-25-7W2
69	SWC	SW34-25-7W2
70	SWC	16-11-26-7W2
71	SWC	3-3-27-7W2
72	SWC	16-4-27-7W2
73	Oil Winsal Jedburgh	12-11-27-7W2
74	SWC	4-15-27-7W2
75	Oil BA Oil Springside	8-29-27-7W2
76	SWC	7-9-28-7W2
77	SWC	NW10-28-7W2
78	SWC	4-14-28-7W2
79	Oil Sohio Theodore STH 1	22-28-7W2
80	SWC	SE-4-29-7W2
81	SWC	SW30-23-5W2
82	Oil Alwinsal McKim	11-6-24-5W2

SE Log No.	Log Type/Name	Land Location
83	SWC	NW34-24-5W2
84	SRC/DOE Yorkton 515	SE1-4-25-5W2
85	SWC	3-17-25-5W2
86	SWC	10-18-26-5W2
87	SWC	NW21-26-5W2
88	Oil Amerada Crown STH 5D	1-29-26-5W2
89	SWC	NW5-27-5W2
90	Oil Seaboard Devil's Lake	15-11-27-6W2
91	SWC	NW11-27-6W2
92	Oil Seaboard Devil's Lake Crown	6-32-27-5W2
93	SWC	5-5-28-5W2
94	GSC Good Spirit Lake	SE4-12-29-5W2
95	SWC	16-21-23-4W2
96	SRC Crescent Lake	SW7-3-24-4W2
97	SRC Leech Lake	NW9-1-24-4W2
98	IWS Yorkton 66-012	SW6-24-24-4W2
99	SWC	4-25-24-4W2
100	SWC	1-26-24-4W2
101	IWS Yorkton 67-003	SW2-34-24-4W2
102	SRC/DOE Yorkton 506	SW4-2-25-4W2
103	SRC/DOE Yorkton 511	NW13-15-25-4W2
104	SRC Yorkton 517	SW2-21-25-4W2
105	Hall Yorkton Weigh Scale 001	NE16-20-25-4W2
106	IWS Yorkton 65-023	SW5-31-25-4W2
107	IWS Yorkton 65-010	SW12-31-25-4W2
108	IWS Yorkton 65-019	NW13-7-26-4W2
109	IWS Yorkton 65-017	NW4-20-26-4W2
110	IWS Yorkton 65-018	SW1-30-26-4W2
111	SWC	16-21-27-4W2
112	SWC	NE16-27-28-4W2
113	Oil Trans Era STH 2	3-12-24-3W2
114	Oil Trans Era STH 3	1-13-24-3W2
115	Oil SWP Clonmel	13-36-24-3W2
116	SRC/DOE Yorkton 528	SW13-36-24-3W2
117	SWC	SW4-11-25-3W2
118	SRC/DOE Yorkton 525	SE15-17-25-3W2
119	IWS Yorkton 66-009	NW13-29-25-3W2
120	SRC/DOE Yorkton 526	SE1-18-26-2W2
121	DOE	SW34-26-2W2
122	SWC	SW9-12-28-2W2
123	SRC Rhein	NE16-14-28-2W2

SE Log No.	Log Type/Name	Land Location
124	SWC	13-20-24-32W1
125	Oil Rio-Tinto STH 4	4-18-26-32W1
126	Oil Rio-Prado Wroxton	8-13-26-33W1
127	Oil Rio-Tinto STH 2	2-25-26-33W1
128	SWC	15-30-26-32W1
129	Oil Rio-Tinto STH 1	3-5-27-32W1
130	SWC	8-5-28-32W1
131	DOE	SW16-28-32W1
132	DOE	SW27-28-32W1
133	SWC	SE36-23-30W1
134	SWC	NE34-23-30W1
135	SWC	4-2-24-30W1
136	DOE	NE4-24-30W1
137	DOE	SE36-24-31W1
138	DOE	SW10-25-31W1
139	Oil Rio-Tinto STH 10	4-27-25-31W1
140	Oil Rio-Tinto STH 7	3-5-26-31W1
141	Oil Rio-Prado	1-9-26-31W1
142	Oil Amerada Crown S-AI	5-29-26-30W1
143	SRC Togo 2	4-1-27-30W1
144	SWC	7-11-27-30W1
145	SWC	14-23-27-30W1
146	SRC Runnymede	SE9-4-29-30W1