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The Integrated Assessment of Water Resources for Unconventional Oil and Gas Plays, West-Central Alberta Project

YEAR 1 OVERVIEW REPORT

JULY 6, 2013

An Alberta Upstream Petroleum Research Fund (AUPRF) supported Project

INTEGRATED WATER RESOURCES

Contents

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The companies listed above form Integrated Water Resources, a team which brings together experts with broad experience in water resource evalutation and management for unconventional oil and gas plays.

This Report Submitted to: the Petroleum Technology Alliance of Canada as manager of the Alberta Upstream Petroleum Research Fund (AUPRF).

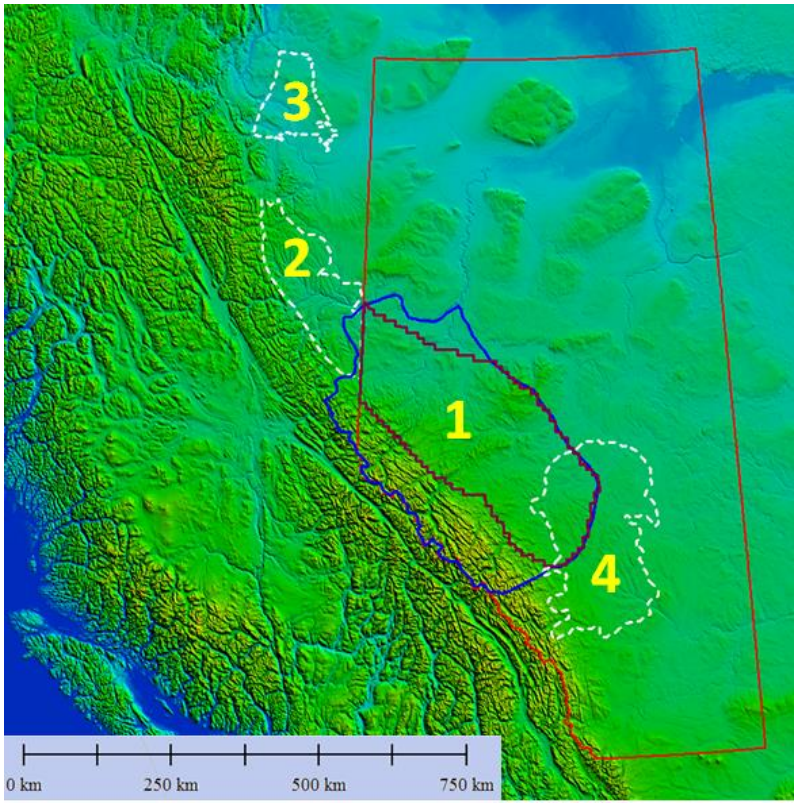
1. Introduction and Context

This report provides an overview of the Integrated Assessment of Water Resources for Unconventional Oil and Gas Plays, West-Central Alberta Project (The Project; Figures 1 and 2), and details the related processes, products and services that were completed between June 1, 2012 and May 31, 2013. Year 1 of the Project was co-funded by Petroleum Technology Alliance of Canada's (PTAC)[1] Alberta Upstream Petroleum Research Fund (AUPRF) and a partnership of eight oil and gas companies. The intent of this paper is to summarize the project and identify key outputs stemming from Year 1 of the regional water inventory project.

The AUPRF supports collaborative research and development for upstream oil and gas, where research results are used by governments and regulators to set or revise environmental guidelines, and by industry to establish best practices. PTAC manages and administers funding for projects and it also assists with dissemination of project results.

The Year 1 project funding sponsors are: Cequence Energy, Chevron Canada Resources, Canadian Natural Resources, ConocoPhillips Canada, EnCana Corporation, Husky Energy, Shell Canada and Talisman Energy.

The project is being conducted by Integrated Water Resources (IWR), a team of three consulting companies; Foundry Spatial Ltd., Petrel Robertson Consulting Ltd., and Strategic West Energy Ltd. These three firms have broad experience in water-related projects associated with unconventional oil and natural gas plays.



Legend

1. West Central Alberta Project
2. Montney Project
3. Horn River Basin
4. Edmonton-Calgary Corridor (ECC)

West-Central Alberta Project

- 1200 Townships
- Surface area (blue) 142,000 km^2
- Sub-surface area (red) 91,000 km^2
- 5 times larger than Montney Project
- 1.75 times larger than Edmonton-Calgary Corridor Groundwater Atlas area

Figure 1 Outline of the project area in west-central Alberta and relative to other regional water projects.

[1] PTAC's mission is to facilitate innovation, collaborative research and technology development, demonstration and deployment for a responsible Canadian hydrocarbon energy industry. PTAC has facilitated the Alberta Upstream Petroleum Research Fund (AUPRF) for over 10 years.

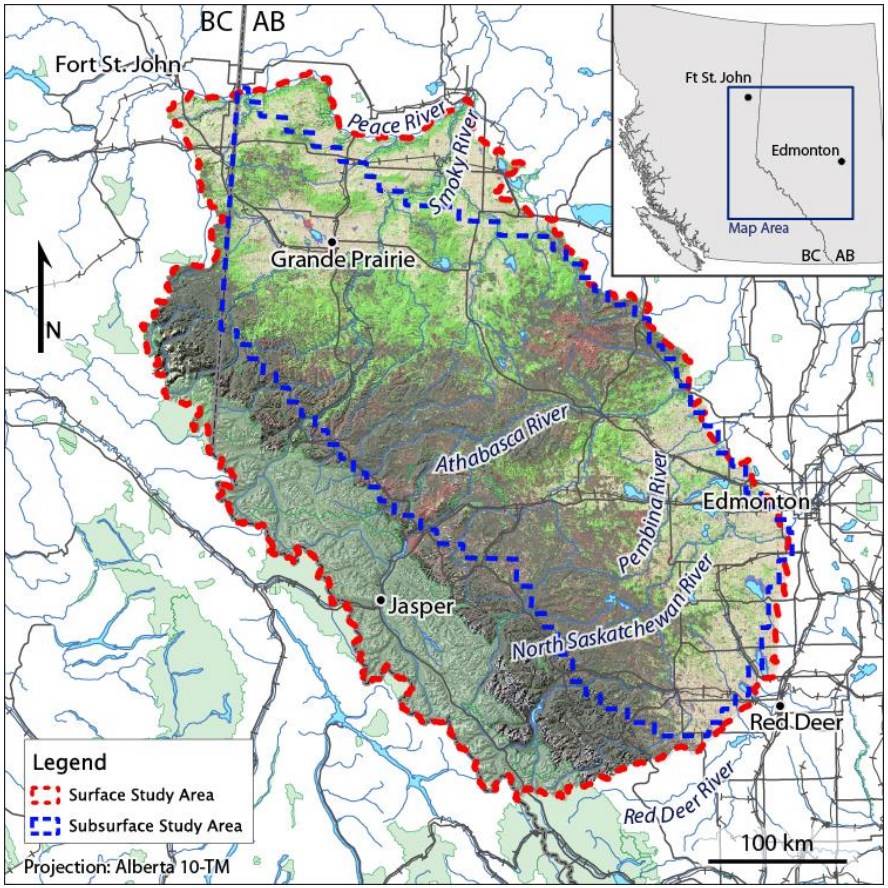


Figure 2 Detail of the Project Area showing delineation of surface and subsurface project area.

Recently, this group completed the Montney Water Project - a comprehensive water source and disposal assessment - for Geoscience BC (reports and maps can be found at the Geoscience BC Website). In addition, the team mapped deep saline aquifers in the Horn River Basin and modeled surface water resources in northeast British Columbia (see website link above). IWR members have also addressed water-related issues for government and industry operators in the Central Mackenzie Valley of the Northwest Territories and in various Yukon basins. More information about these other projects can be found at the Integrated Water Resources website.

The Project aligns with other water-related initiatives, including Alberta's Water for Life Strategy, and the Alberta Water Council recommendations for enhancement of baseline groundwater information and enhancement of analysis, interpretation and reporting tools. It focuses on water sources and fluid disposal (Figure 3) that are within the broader water and fluid management cycle for unconventional activities. In addition, the Project supports the Canadian Association of Petroleum Producers' (CAPP) Guiding Principles for Hydraulic Fracturing (see CAPP Website) and supports CAPP's hydraulic fracturing operating practice #5: Water Sourcing, Measurement and Reuse.

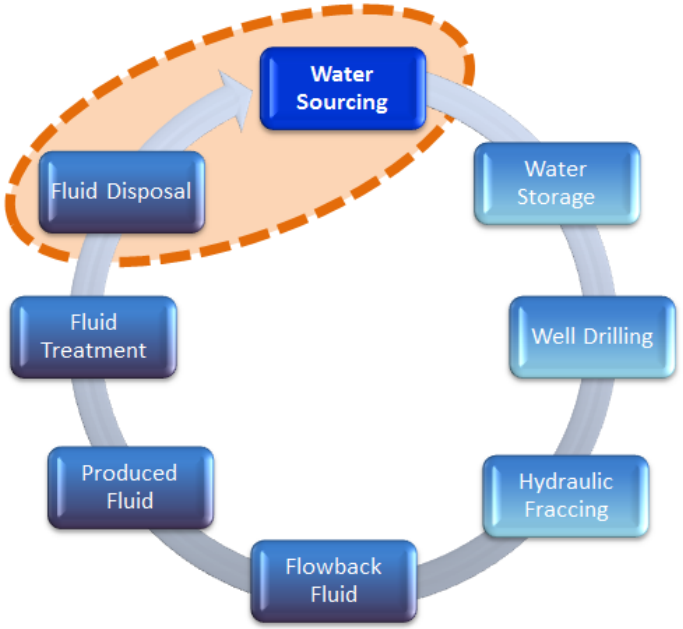


Figure 3 The Project focuses on water sources and fluid disposal within the broader water and fluid management cycle.

Unconventional Regulatory Framework

The Alberta Government is currently reviewing comments provided by stakeholders on its "Regulating Unconventional Oil and Gas in Alberta – a Discussion Paper". This is part of the unconventional regulatory framework (URF), which will have proponents address critical outcomes at the play-scale, related to water management, waste management, orderly development and information and advice. Outputs from the Project will enable proponents to respond to these new and emerging regulatory requirements. Additionally, the Project is designed to inform and provide key inputs into URF's critical outcomes. This includes industry collaboration toward water management planning at the play-scale.

2. The Integrated Assessment of Water Resources for Unconventional Oil and Gas Plays, West-Central Alberta Project

Year 1 provided a regional overview of water resources in west central area of Alberta. In Year 2 there will be renewed efforts to include Provincial Government participation where appropriate. The Year 1 project outcomes will provide an inventory and digital compilation of publicly available information on water resources in the project area.

The Project is focused on developing an inventory of the water resources in the area shown in Figures 1 and 2. This is an extremely large area, the surface component is 142,000 km^2; the sub-surface area is 91,000 km^2, or about 1200 townships. This project's subsurface area is 5 times the size of the Montney Water Project in northeast British Columbia (Brown, 2011; Hayes et al., 2011); 7 times the size of the Horn River Basin study (Hayes, 2010), and 1.75 times larger than the Edmonton–Calgary Corridor Groundwater Atlas area (Barker et al., 2011).

Project Goals

A fundamental goal of the project is to assess all potential water sources, including:

- Surface waters;
- Shallow aquifers in unconsolidated materials and bedrock; and,
- Deep saline aquifers.

The deep aquifers are also being assessed as potential deep disposal zones for flow-back and produced fluids generated during oil and gas exploration and production.

Other goals include:

- To establish collaborative regional water projects that can play an important role in science-based discussions; and,
- Making water information available to support broader company and regulatory decision-making.

Project Governance

In Year 1, the Project was guided by a technical advisory group composed of sponsor companies (producers), and CAPP. The Technical Advisory Group met every two months to review progress and provide advice. In addition, the consulting team invited Government representatives (Alberta Environment and Sustainable Resource Development and the Alberta Energy Resources Conservation Board) to these regular meetings to stay informed about project activities. The Alberta Geological Survey was invited to participate but they were unable to devote staff to the project in Year 1. From an administrative standpoint, PTAC acts as the financial manager of project funds.

Project Area Description

The Project includes an extensive area of oil and natural gas resources and activity. It covers over 142,000 km^2 of surface terrain and 91,000 km^2 of sub-surface area, as depicted in Figure 2. The Project area extends from the BC-Alberta border southeast about 500 km to Red Deer. It includes numerous historic and producing conventional fields and new emerging unconventional play fairways, including the Montney and Duvernay plays of Alberta.

The sub-surface portion of the project area is bounded along the southwest by the deformed belt (Rocky Mountain Foothills), to the northwest by the B.C. border, and to the northeast and southeast by the up-dip limits of the Duvernay and Montney play fairways. The surface area follows natural watershed boundaries along the northeast side of the subsurface, and extends to the continental divide or upstream limit of contributing watersheds for drainages flowing through the subsurface project area.

Geological Setting

The subsurface portion of the Project area lies on the western flank of the Western Canada Sedimentary Basin, where the prospective sedimentary succession measures more than 4000 m thick. Strata are relatively undeformed, and dip uniformly southwestward toward the Rocky Mountain Foothills. This setting hosts an extensive basin-centred hydrocarbon regime (the "Deep Basin"), containing numerous unconventional oil and gas plays in shales, tight sandstones, and tight carbonates. To the west, fold and thrust deformation in the Foothills breaches the Deep Basin regime and destroys the regional seals trapping oil and gas in unconventional plays.

Petroleum Industry Activity

West-central Alberta offers rich and productive petroleum systems, and historically has been intensively explored for conventional oil and gas plays. With the development of horizontal drilling and multi-stage hydraulic fracturing technologies, industry has discovered huge unconventional play potential as well. Not only can high production rates and large per-well reserves be achieved, most unconventional plays are prospective over large, continuous areas. Thus, we can foresee extended-reach horizontal wells being drilled over much of west-central Alberta, with each being stimulated with multiple-stage hydraulic fracturing, with the majority requiring large volumes of water.

Devonian Duvernay shales and Triassic Montney siltstones have attracted a great deal of attention in west-central Alberta, and industry has spent billions of dollars leasing petroleum and natural gas rights. Challenging horizontal wells have been drilled, some of which have yielded spectacular initial flow rates and reserves potential. Both plays are prospective over large areas. They offer abundant gas potential in the deeper, more mature portions of the basin in the west, and more oil and liquids potential in easterly areas where maturity levels are lower.

The boundaries of the Project have been drawn to encompass the fairways where one or both of these plays are prospective (Figure 4). However, numerous other plays offer unconventional oil and gas potential within the project area that is now being accessed using horizontal, multi-stage hydraulic fractured wellbores. These include:

- Swan Hills (Devonian) – tight carbonates. Predominantly oil, prospective across broad platform areas;
- Glauconitic / Bluesky / Wilrich (Cretaceous) – tight sandstones, prospective for gas and oil, particularly attractive where continuous thick marine sandstone bodies can be mapped;

- Falher / Notikewin (Cretaceous) – tight valley-fill sandstones, yielding primarily liquids-rich gas along sharply-defined trends;
- Cardium (Cretaceous) – tight sandstones, predominantly oil, particularly prospective in a broad "halo" of lower-grade reservoir flanking historical conventional pools such as Pembina; and,
- Other Mesozoic tight sandstones, such as the Rock Creek, basal Belly River and Dunvegan, where thick local accumulations are prospective for horizontal development of oil and gas.

With the productive potential of all of these plays now being established, it is clear that industry will have long-term needs for large volumes of water to undertake horizontal, multi-stage hydraulic fracturing drilling programs, along with requirements for safe disposal zones for flow-back and produced fluids.

Geographic Setting

The surface project area includes parts of the Peace / Smoky, Athabasca, North Saskatchewan and Red Deer River watersheds. The eastern extent of the project area is bounded by natural watershed boundaries, and to the west extends to the headwaters of these systems. High alpine and glaciated terrain in the Rocky Mountains grades into coniferous forests in the foothills, which extends northeastwards along the drainage divide between the Smoky and Athabasca Rivers. North and southeast of the divide, ecosystems pass through aspen and poplar dominated forests to the grassland and agricultural areas of Grande Prairie / Dawson Creek, and Edmonton / Red Deer, respectively.

Glacial sediments dominant the landscape, with vast expanses of morainal and glacio-lacustrine material typically deposited in a relatively thin cover (<10m) over the uppermost bedrock units. Coarser grained sediments are interspersed across the project area, and provide

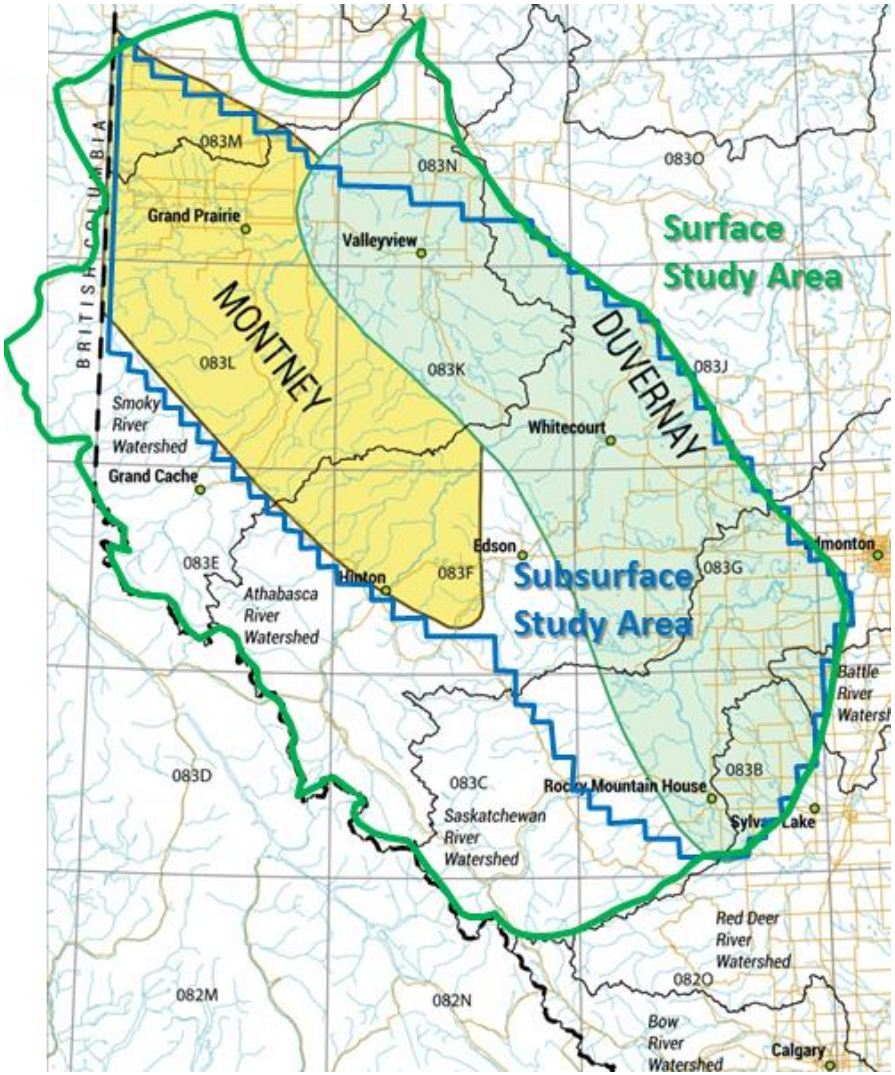


Figure 4 Unconventional oil, liquid-rich natural gas and dry natural gas plays include the Montney and Duvernay plays.

important sources of groundwater where laterally extensive, or confined below morainal material in paleovalleys.

The project area falls within the Continental/microthermal climate of the Koppen climate classification system. Precipitation is relatively evenly distributed throughout the year, with summer temperatures cooling with increasing elevation towards the Rocky Mountains. The quantity and timing of precipitation varies substantially across the project area and plays an important role in surface water resources.

3. Project Components

Three separate Year 1 technical reports for: (a) surface water; (b) shallow aquifers; and (c) deep saline aquifers will be available to project partners by June 30, 2013. Six months after this, these reports will be available to the public via the PTAC and Integrated Water Resources websites.

Component 1 Surface Water

Information on surface water resources was collected from a significant body of pre-existing research. This included "State of the Watershed" reports prepared by Watershed Planning and Advisory Councils, as well as numerous government and academic publications describing water resources. A large amount of spatial data on various components of the water cycle was collected and used to identify the characteristics of each component across the project area. This database will be provided to project partners for incorporation in their corporate systems. Hydrologic analysis will be undertaken in Year 2 to characterize regional and seasonal patterns of water availability at the watershed scale, building on the database of information collected.

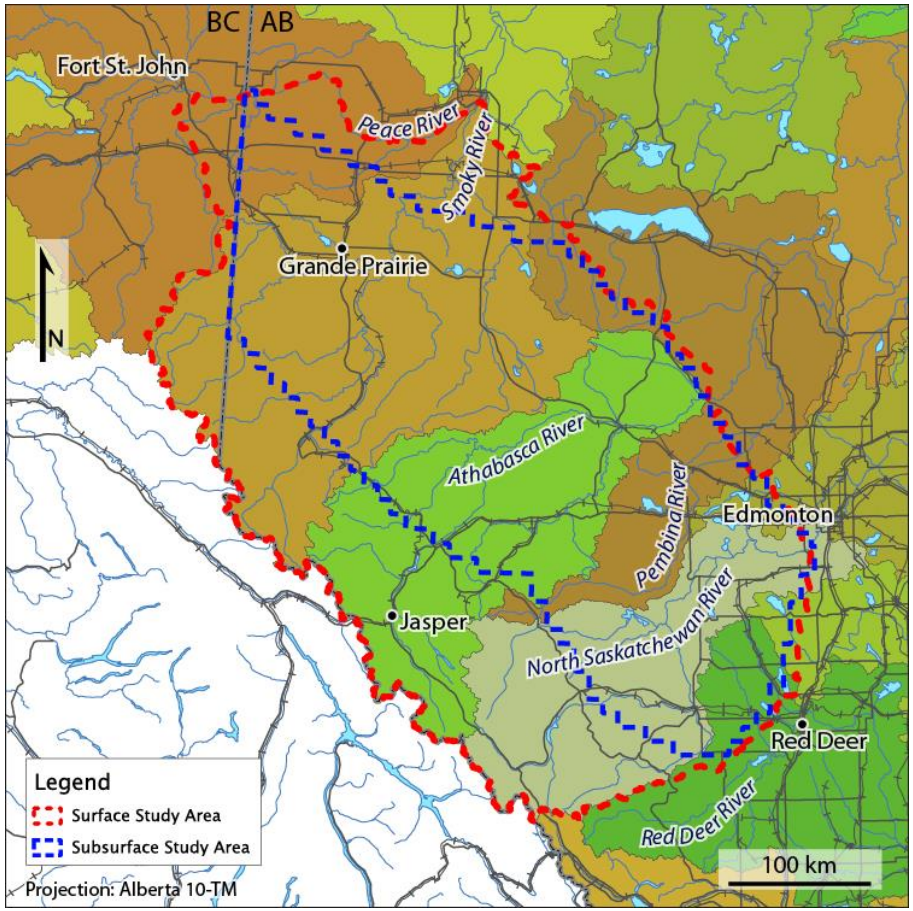


Figure 5 Study Area surface and subsurface boundaries showing four main watersheds: Peace (including Smoky); Athabasca (including Pembina); North Saskatchewan; and, South Saskatchewan (including Red deer).

Watersheds

Four of Alberta's major watersheds are found within the project area (Figure 5): (1) Peace (including Smoky); (2) Athabasca (including Pembina); (3) North Saskatchewan; and, (4) South Saskatchewan (including Red Deer) extend across the project area. The first three flow north, eventually into the Arctic Ocean, while the last flows into Hudson's Bay.

Data Compilation

Data were collected, and used to populate a database framework for key components of water cycle, including:

- Climate
- Vegetation / Land Use
- Terrain (DEM)
- Bathymetry
- Surficial geology
- Evapotranspiration
- Terrain (DEM)
- Soils
- Infiltration capacity
- Hydrometric monitoring
- Rivers, lakes, streams and watersheds
- Weather stations and snow pillows

Analysis

Using over 30 sub-basins identified by the Prairie Farm Rehabilitation Administration and the Water Survey of Canada, unique characteristics of the individual basins were assessed using spatial analysis. The results of the analyses provide information on:

- Monthly precipitation and temperature
- Active weather stations in the area
- Vegetation / landuse makeup of the sub-basin
- Historical and current hydrometric monitoring
- Annual runoff, flood and drought flows
- Previous estimates of surface runoff amounts from several studies (Bell 1994, Alberta Environment 2008, Agriculture and Agri-Food Canada 2013)
- Surficial materials, infiltration and recharge

Results

Several dozen of the geographic information system (GIS) data layers compiled have been loaded into NOLA (an internet mapping framework developed by Foundry Spatial). Project partners can currently investigate the characteristics of the various layers across the project area visually, and also interact with the analysis results which quantify the unique characteristics of each sub-basin.

Results of the sub-basin analyses are included in the detailed surface report and discussion is beyond the scope of this overview. Regionally, a broad summary can be made. Runoff is greater in the Rocky Mountains and foothills, and decreases moving towards the plains.

The area between Fox Creek and the Swan Hills is interpreted to have greater runoff, however, than the areas north and southeast from there. Watershed size is the dominant factor controlling the gross volumes of water flowing through drainages, and is the key piece of information that should be considered when evaluating potential water supply on an ungauged river or stream.

Data compiled during the first year of the project and results of the sub-basin analyses will form the basis of the Year 2 work. Detailed analysis of gauged hydrometric basins within the project area will identify key factors influencing surface water resources and build the foundation for modeling outside of these gauged basins. The quantitative modeling will account for existing licensed use and be integrated with Year 2 activities investigating groundwater aquifers in connection with surface water.

During Year 1 the project team worked to build a relationship with Alberta government agencies. An initial Year 2 initiative will be to engage with government staff in a technical workshop to identify key information requirements in support of regional water strategies and individual license applications.

Component 2 Shallow Aquifers in Unconsolidated Sediments and Shallow Bedrock

For the purposes of this Project shallow aquifers occur from just below surface down to the depth designated by Alberta Energy Resource Conservation Board as the base of groundwater protection (BGWP)[2]. These include unconsolidated sediments dominated by glacial deposits, and shallow bedrock.

The following data sources have been compiled into the spatial framework to assess the shallow aquifers across the Project area:

1. Quaternary geology maps
2. Sand and gravel (aggregate potential) maps
3. Drift thickness and bedrock topography maps and data
4. Thalweg maps and data
5. Hydrogeology reports and maps
6. Paskapoo isopach and sandiness

Most of these materials were obtained from the Alberta Geological Survey, Alberta Research Council (ARC), and the Prairie Farm Rehabilitation Administration (PFRA).

[2] The BGWP is described as a theoretical surface beneath the ground where the concentration of total dissolved solids (TDS) in the water is equal to 4,000 mg/L. It also separates non-saline water (water having a TDS concentration of less than or equal to 4,000 mg/L) and saline water (water having a TDS concentration greater than 4,000 mg/L).

Unconsolidated Materials

The entire Project area was glaciated up to about 10,000 years ago, and as a consequence, much is covered by a relatively thin veneer of unconsolidated glacial-fluvial deposits. These diverse materials include both aquifers and aquitards. Provincial and federal government mapping programs have delineated these deposits at various scales in different parts of the Project area.

Thickness of Quaternary Cover across Project Area

The drift thickness across the project area ranges from < 5 m to over 200 m thick (Figure 6). The thickest accumulations occur in buried channels corresponding to paleo-drainage systems. These ancient incised valleys are filled with a variety of glacial deposits. Granular materials from fluvial and glacial-fluvial processes that fill the valleys and can form significant aquifers. The aquifers hosted in unconsolidated sediments can be unconfined and confined[3], and have been regionally delineated by the Alberta Geological Survey and other researchers.

[3] Unconfined aquifer: groundwater in direct contact with the atmosphere through open pore spaces of the overlying unconsolidated materials or rock. Unconfined aquifers are usually recharged by rain or streamwater infiltrating directly through the overlying materials or rock. A confined aquifer is permeable material or rock between confining beds (layers of impermeable materials which impede the movement of water into and out of the aquifer). Confined aquifers may be recharged by rain or streamwater infiltrating the rock at some considerable distance away from the confined aquifer.

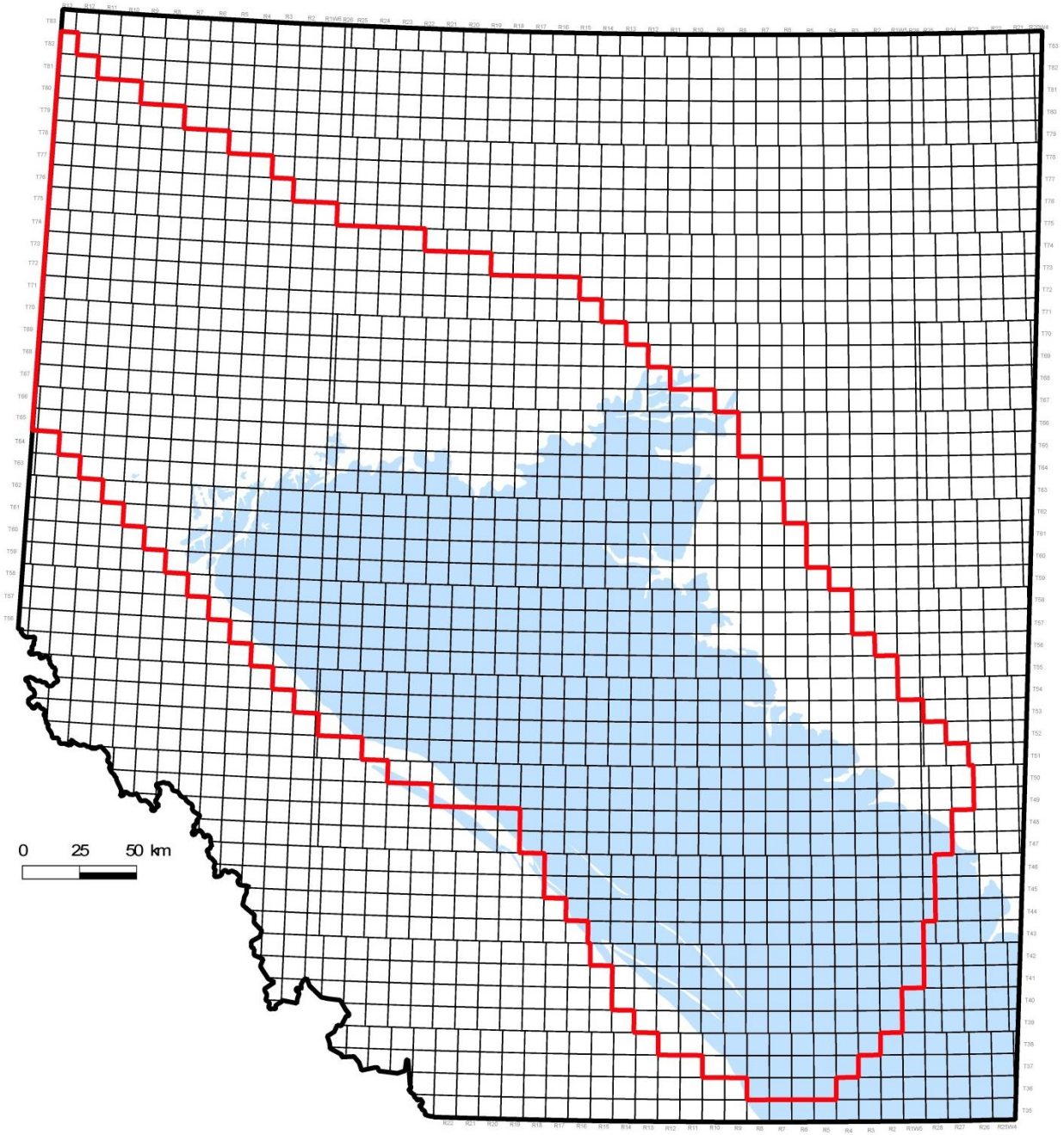


Figure 6 Area of Paskapoo Formation beneath Quaternary unconsolidated cover relative to the Project area.

Shallow Bedrock Aquifers

Continental sandstones, siltstones and mudstones of the Tertiary Paskapoo Formation make up the shallow bedrock over much of the southern portion of the subsurface project area (Figures 7 and 8). To the north, Upper Cretaceous units subcrop beneath the unconsolidated Quaternary cover. There is a substantial body of literature addressing these units (e.g., Lyster and Andriashek, 2012), which has been compiled and summarized in Year 1 of the Project.

The Paskapoo contains predominantly fresh water, and is an important domestic and agricultural water source. While most water wells in the Project area drain relatively isolated channel sandstones of the upper Lacombe Member, the basal Haynes Member is a more continuous aquifer (Figure 8). Beneath much of the Project area, the Haynes is too deeply buried to be a viable domestic or agricultural water source, and thus may represent a valuable potential water source zone to support unconventional gas and oil development.

Detailed subsurface mapping of the Paskapoo, with particular focus on the Haynes Member, is a primary goal for Year 2 of the Project.

Groundwater Well Database

Groundwater use in Alberta is small in comparison with surface water. About 3% of total provincial water allocations are from groundwater sources. However, over 600,000 Albertans, primarily in rural Alberta, depend on water wells to provide their domestic water supplies.

Over 100,000 groundwater wells have been licensed within the project area. Information on these wells is catalogued by the Government of Alberta's Groundwater Information Centre. The database for these wells provides an invaluable source of information on shallow lithology and productivity. The yield data information is useful to delineate the more productive shallow aquifers (see Figure 9).

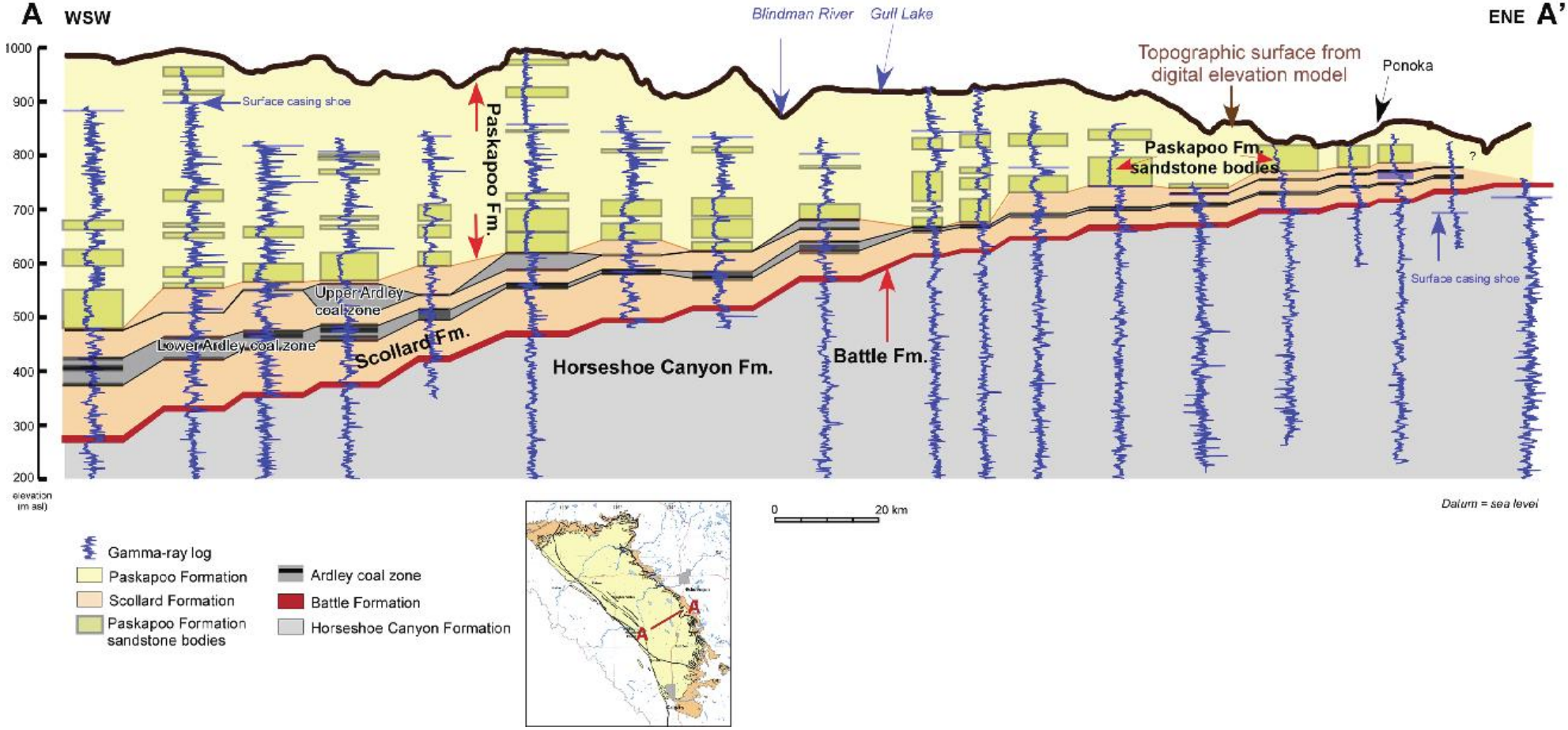


Figure 7 Schematic SW-NE cross-section of Paskapoo Formation across Project area. Note continuity of sandstones in basal portion (Haynes Member) compared to upper part of Paskapoo (Lacombe Member) (from Lyster and Andriashek, 2012).

Results

Using the NOLA framework, the characteristics of shallow groundwater resources as determined from the existing literature will be integrated with surface water and deep saline groundwater information. The potential groundwater yield (Lemay 2009) within each sub-basin and summaries of existing groundwater wells drilled by depth and suggested rate have been analyzed, and are currently available.

A regional map has also been compiled to display the potential groundwater yield across the project area, with existing groundwater wells and lines of section from the ARC and PFRA hydrogeologic reports.

Poster size summaries of the individual reports have been produced, and include cross-sections for reference in conjunction with the overview map.

Component 3 Deep Bedrock Aquifers and Disposal Zones

Characterization of deep bedrock aquifers as potential water sources and deep disposal zones is an important component of the Project. Waters contained in deep aquifers range from brackish to hyper-saline, and by definition lie below the Base of Groundwater Protection depth.
In petroleum boreholes, most deep aquifers occur below the base of surface casing, and thus can be analyzed using wellbore geophysical logs, drill cuttings, cores and test data collected in the course of petroleum exploration and development.

In petroleum boreholes, most deep aquifers occur below the base of surface casing, and thus can be analyzed using wellbore geophysical logs, drill cuttings, cores and test data collected in the course of petroleum exploration and development.

While subsurface hydrogeology of deep aquifers in the Western Canada Sedimentary Basin has been discussed in literature on a very regional basis (e.g., Bachu, 1999), much more detailed assessment of aquifer characteristics is required to support the objectives of the Project. An initial review of the entire stratigraphic column allowed us to identify six deep saline aquifer units with broad regional extent and generally favourable reservoir properties (Figure 10).

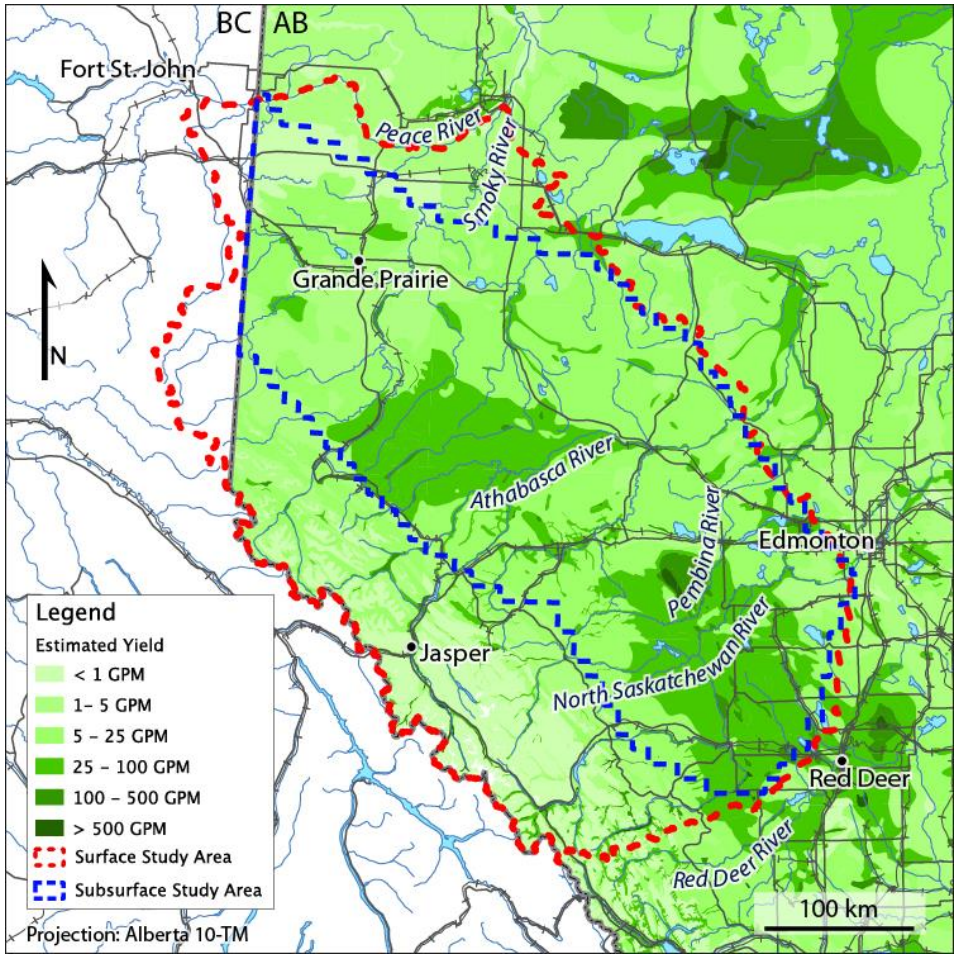


Figure 8 Estimated potential groundwater yield in the Study Area (Lemay 2009).

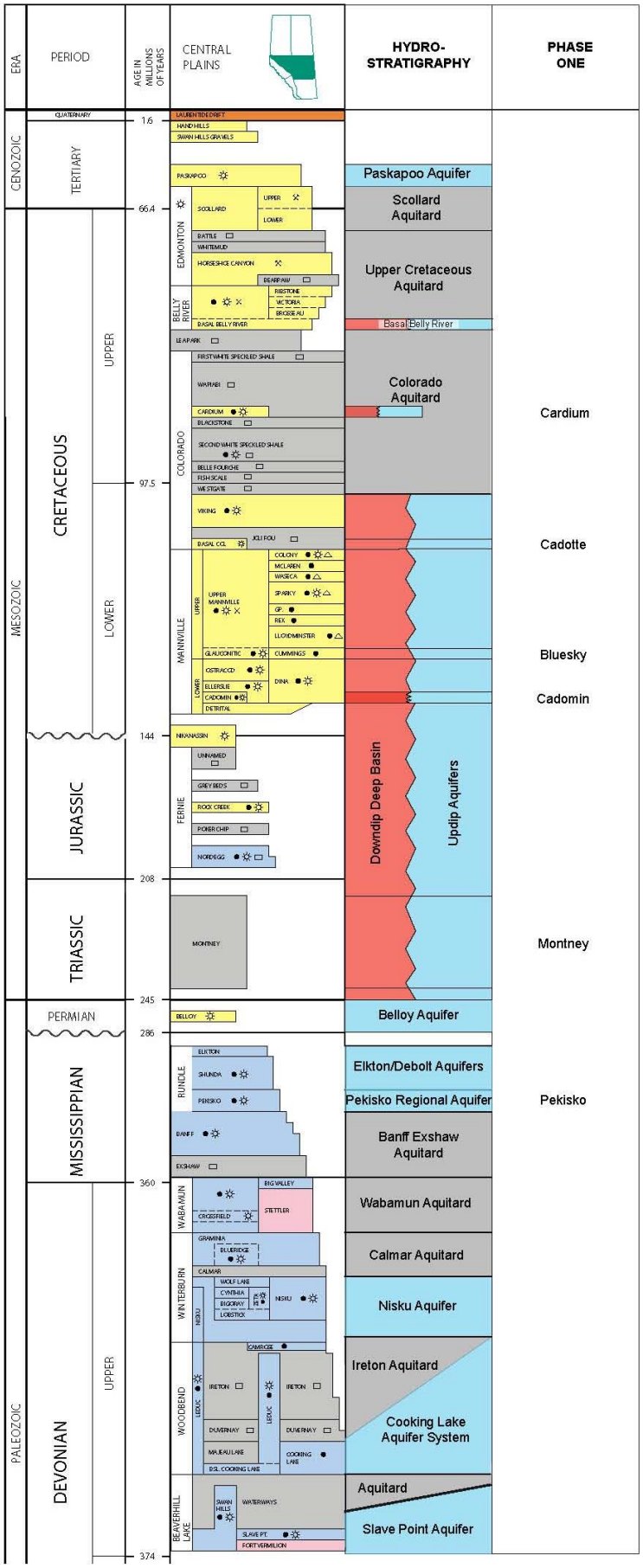


Figure 9 Regional stratigraphic column (figure provided by Petrel Robertson Consulting).

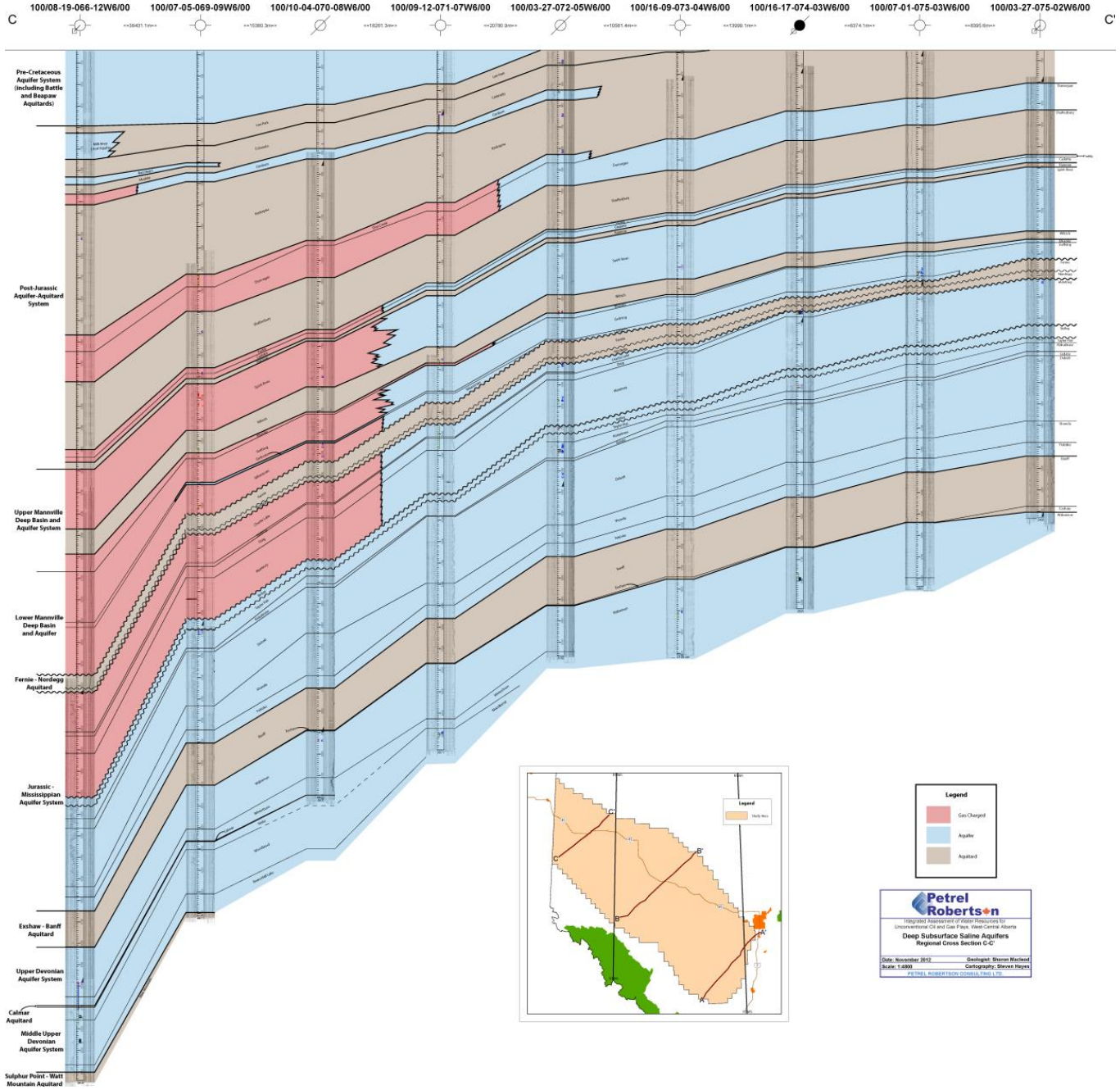


Figure 10 Schematic SW-NE subsurface cross-section, illustrating westerly Deep Basin regime (coloured red) in Mesozoic formations, and up-dip regional aquifers (coloured blue). Note that in the west, where much unconventional gas and oil prospectivity occurs, there is little aquifer potential between shallow units (generally bearing fresh water) and deep, hyper-saline aquifers.

These are (youngest/shallowest to oldest/deepest):

1. Cardium Formation (Upper Cretaceous)
2. Cadotte Member (Lower Cretaceous)
3. Bluesky Formation (Lower Cretaceous)
4. Cadomin Formation (Lower Cretaceous)
5. Montney Formation (Triassic)
6. Pekisko Formation (Mississippian)

In Year 1, we undertook a study of each aquifer using petroleum borehole data to support regional mapping and to characterize reservoir rock and fluid properties. For the Year 1 technical report, the following suite of maps will be presented for each unit:

- Gross isopach
- Net porous reservoir isopach
- Evaluated DST's / hydrogeologic regimes
- Oil, gas and water production
- Water Chemistry
- Potentiometric (piezometric) surface
- Depth to formation top

Detailed review of each major aquifer unit is beyond the scope of this overview report, but a few key points are important to make here:

1. Much of the Mesozoic (Triassic through Cretaceous) section, which hosts a number of important reservoir units in west-central Alberta, is within the Deep Basin regime, as discussed in the Geologic Setting portion of this report (Figure 11). As a consequence, there is little deep saline aquifer potential in the western part of the Project area above the very deep hyper-saline aquifers of Devonian age.
2. Good deep saline aquifer potential is thus stacked up in the northeastern flank of the project area, as highlighted by the summary maps for the Cardium, Cadotte and Bluesky units (Figures 12-14).
3. Mississippian carbonate aquifers (e.g., Pekisko Formation, Figure 15) offer aquifer potential further to the south and west, but at greater depths and with more saline formation waters (TDS > 100,000 mg/l).

Component 4 Project Management, Integration and Communication

The Project is overseen and managed by Strategic West Energy Ltd. This entails stimulating collaboration, scheduling and organizing regular project meetings with project sponsors to provide progress updates, and tracking the project budget. PTAC also requires quarterly reporting on the project.

A fundamental aspect of the project is the integration of all potential water sources. This challenge is partly being addressed by Foundry Spatial and their design of the database framework and delivery platform. One goal is to ensure that spatial data and data for each water source can be compared and contrasted in any given area in the project area.

Communication initiatives in Year 1 were limited to within the project sponsors and several general presentations to technical audiences and industry events.

The project team will work collaboratively with industry partners and government to disseminate water-related information to broader groups, in Year 2, once more information is compiled and fully synthesized.

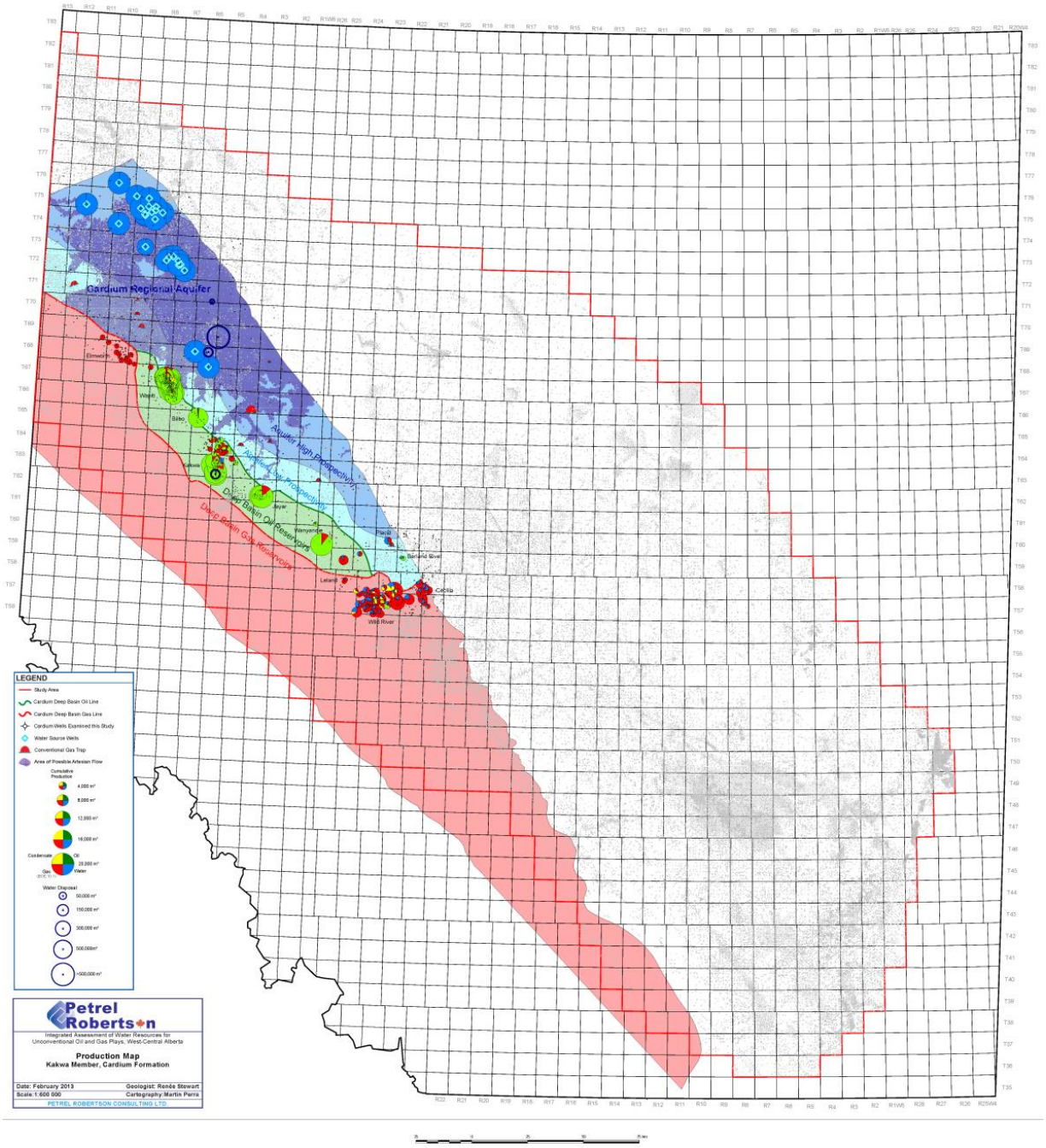


Figure 11 Aquifer summary map for the Cardium Formation (Upper Cretaceous). Dark and light blue areas demonstrate excellent and more limited aquifer potential, respectively. Green area is Deep Basin oil, and red area Deep Basin gas. There are numerous existing water source wells (large blue circles).

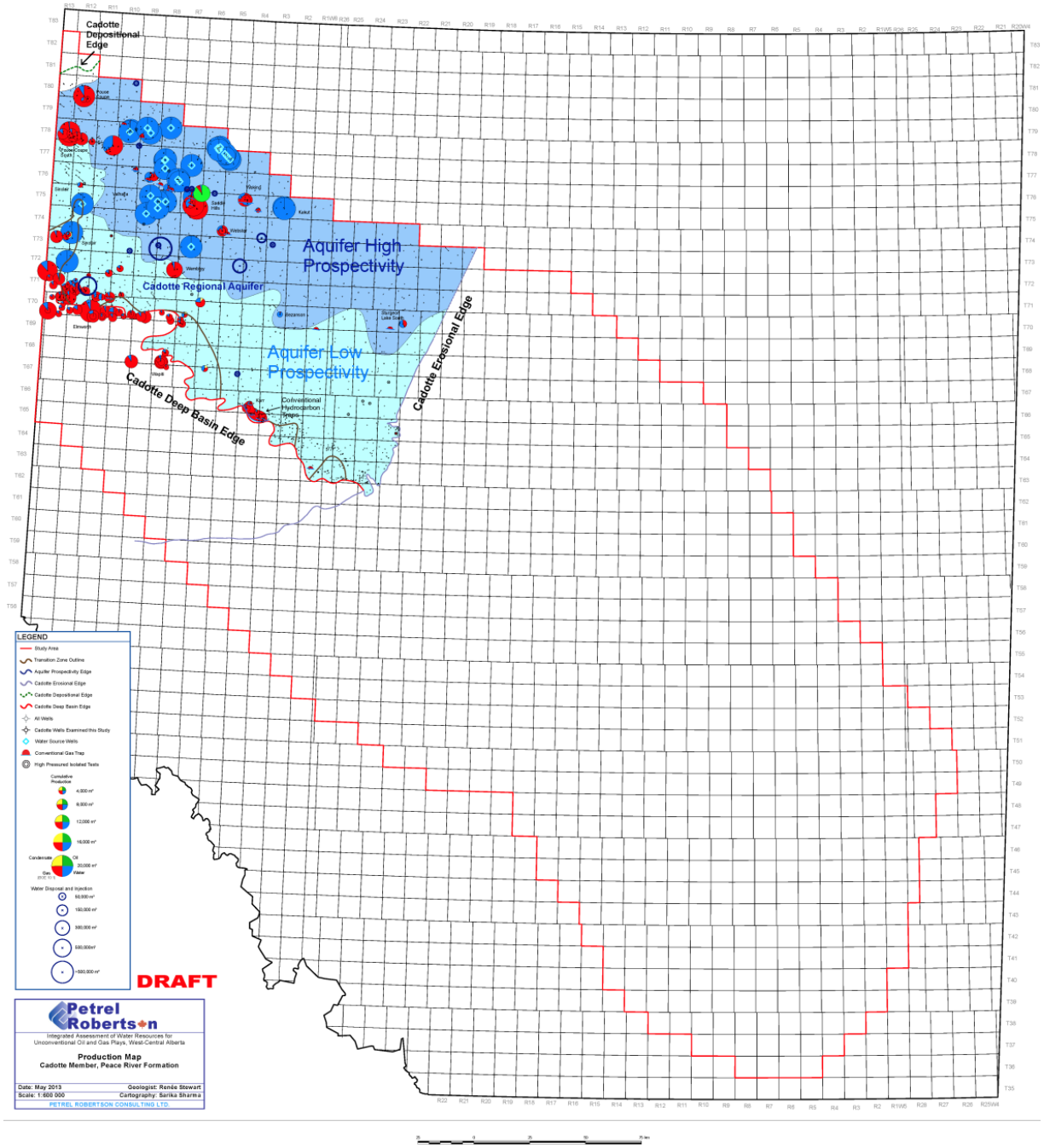


Figure 12 Aquifer summary map for the Cadotte Member (Lower Cretaceous). Dark and light blue areas demonstrate excellent and more limited aquifer potential, respectively. There are numerous existing water source wells (large blue circles).

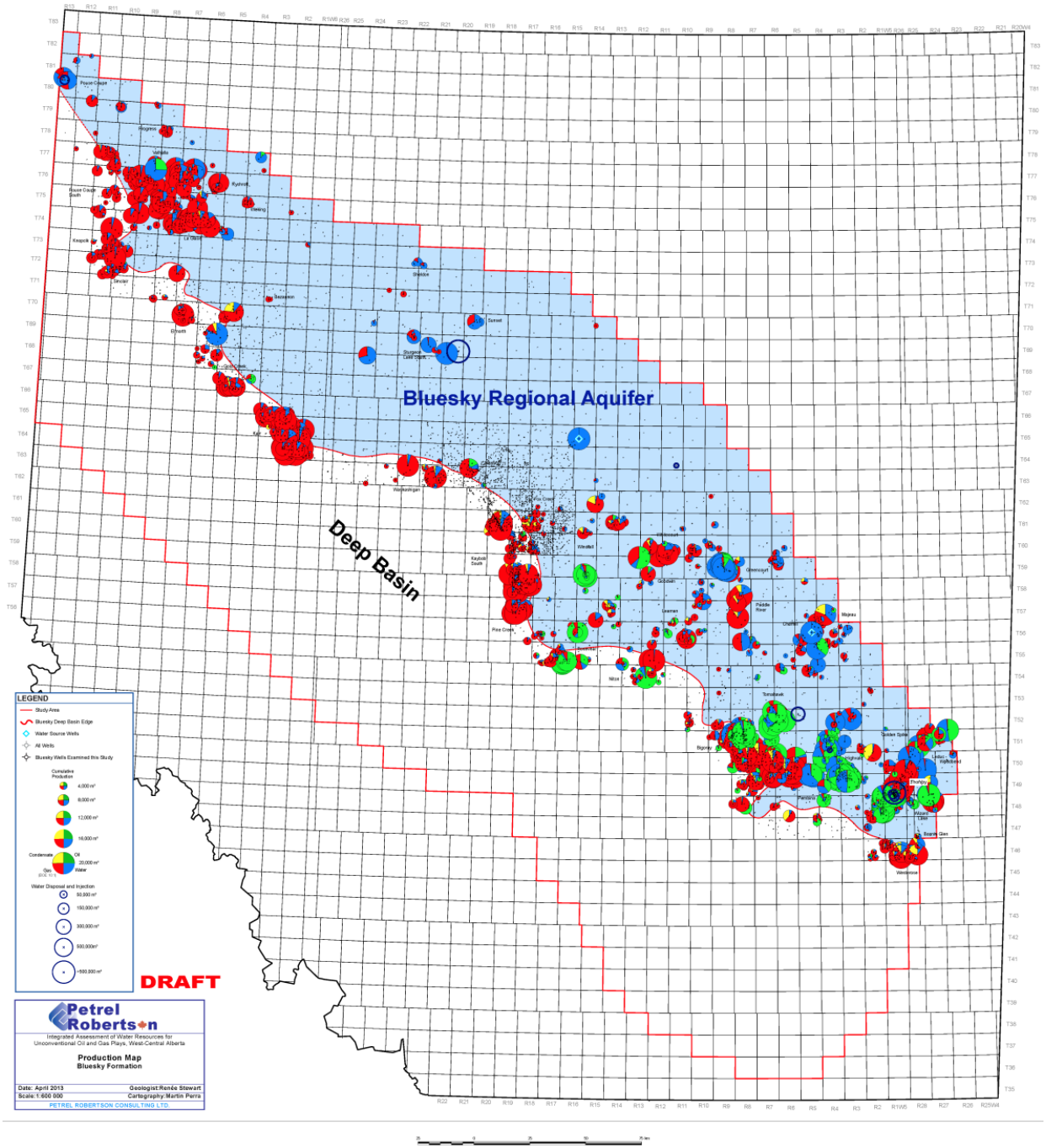


Figure 13 Aquifer summary map for the Bluesky Formation (Lower Cretaceous). This is a complex unit, and although aquifer prospectivity spans a broad area, aquifer quality is highly variable, and additional work will be required to highgrade areas with sufficient potential to support unconventional operations.

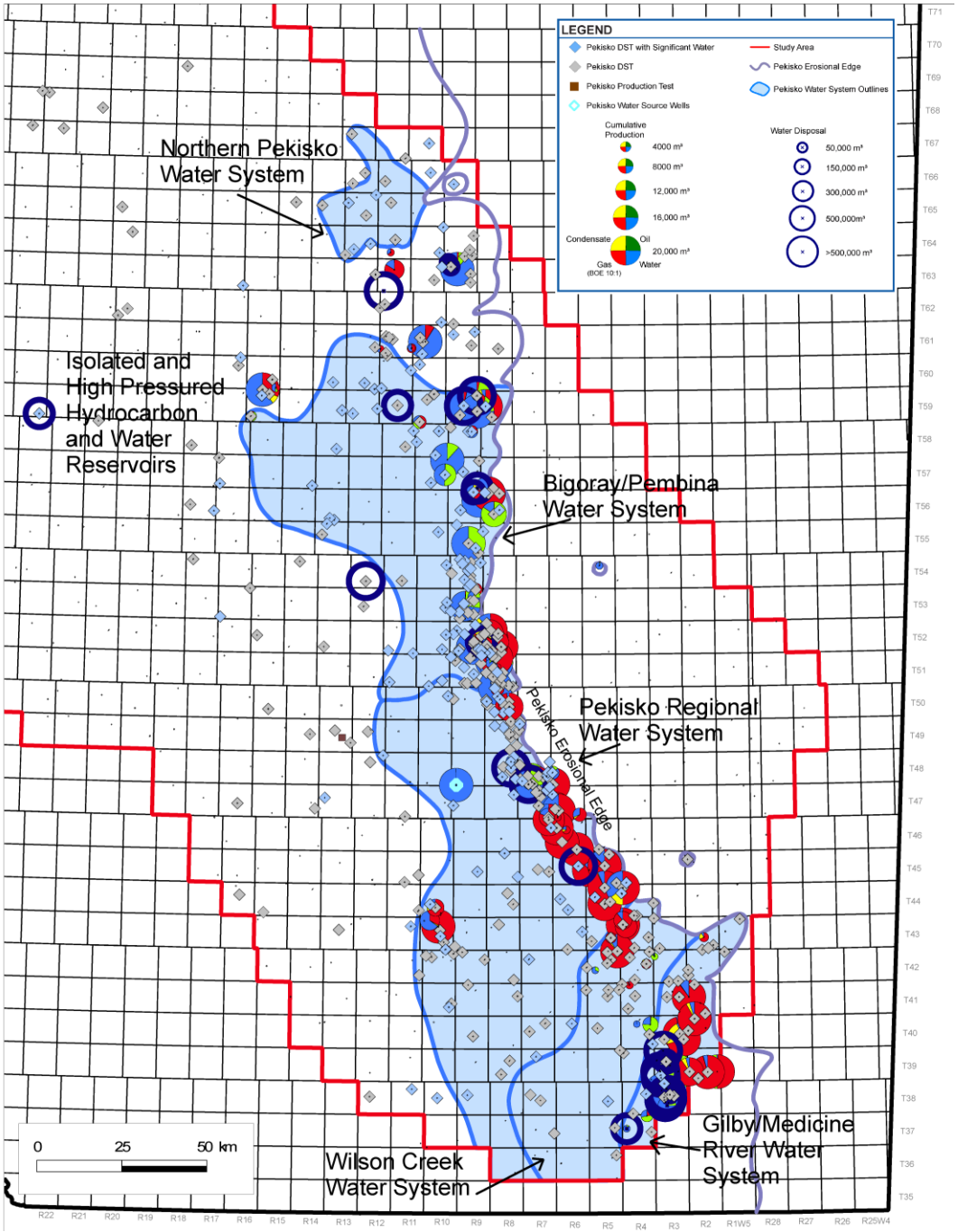


Figure 14 Aquifer summary map for the Pekisko Formation (Mississippian). Regional aquifer potential occurs downdip (west) of stratigraphically-trapped hydrocarbons along the eastern edge, which subcrops beneath pre-Mesozoic unconformities. A similar aquifer trend can be defined further west (and more deeply buried) for the overlying Elkton / Turner Valley carbonate unit (map provided by Petrel Robertson).

4. Year 1 Project Deliverables

The Year 1 project deliverables include: (1) this overview paper; (2) three separate technical final reports on surface water , shallow aquifers and deep saline aquifers; (3) project materials posted on the Integrated Water Resources website with public and partners access.

- Deep saline aquifer maps and plots
- Shallow hydrogeology compilation map and report summaries
- GIS database of surface water, shallow groundwater and deep saline information
- Annotated bibliography / reference list of existing surface water and shallow groundwater research
- Selected key GIS layers, and results of sub-basin analyses provided to partners through NOLA for the project duration.

5. Year 2 Proposed Plans

The Project was designed as a multi-year, collaborative effort that is intended to include consultants, Government agencies, industry, First Nation and community participation. Year 1 was completed by the Integrated Water Resources team of consultants. Year 2 will include continued, strengthened engagement with Alberta Energy Regulator (AER), Alberta Environment and Sustainable Resource Development (ESRD) and others. These agencies will be invited to contribute either directly within the Project, or in complementary ways outside the project.

Year 2 efforts will continue investigating the three water source environments: (1) surface, (2) shallow groundwater, and (3) deep bedrock aquifers. The transition into Year 2 activities will commence in June, 2013. A Year 2 overview report will be provided in June 2014.

6. Conclusion

The Integrated Assessment of Water Resources for Unconventional Oil and Gas Plays, West-Central Alberta Project is designed to provide independent 3rd party water inventory information across a large portion of Alberta, where unconventional oil and gas exploration and development is occurring. Year 1 concentrated on the compilation and initial synthesis of broad and diverse data sources. Year 2 will include the continued synthesis of data; the examination of data in more detail in targeted portions of the project area; and on the completion of surface hydrological modeling.

The Project will provide a regional framework upon which planning, assessments and operational decisions can be made in support of unconventional resource activities. It will inform companies in their efforts to achieve emerging desired outcomes that the Alberta Government is developing under its new “Unconventional Regulatory Framework (URF)”. The project outputs also have broader application in water-related decision making and discussions in West Central Alberta.

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