SASKATCHEWAN

CAD FILE & GEOREFERENCING

SPECIFICATIONS

As of October 4, 2014

ISC

Introduction:

ISC has introduced a new technology component to the survey plan submission process. This will allow for faster transaction processing, fewer rejections, and increased accuracy in the plans being reviewed and accepted.

Plan Submissions Online is a web-based plan submission and checking tool which auto-verifies that all mandatory information is provided before submitting plans to ISC Plan Processing. Alerts will let customers know if any necessary plan information is missing, or appears to be incorrect, allowing for interactive corrections in a 'work-in-progress' environment. This tool expedites filing and approval, reduces packet rejections, eliminates forms and advances service delivery, facilitating system and process efficiencies.

The New Process

- Intelligent or geometric (AutoCAD dwg) files will be required along with the image file (.tiff or .pdf);

- Plans will be required to follow standardized layer specifications;

- Surveys submitted must have two points georeferenced to the NAD83(CSRS) datum UTM Extended Zone 13 in order to be approved for filing in the Land Surveys Directory.

The new Plan Submissions Online process will allow technology to validate essential data upfront before the plans reach the examiners, making the plan approval process more efficient for both clients and ISC.

ISC is committed to ensuring the services provided are of the highest standard however, it is important to note that surveyors remain professionally responsible and liable for the quality and accuracy of the field survey and the resulting registered plan of survey. As such, ISC underwent extensive consultation with client and industry groups. Input was provided from the Surveyor Working Group and the SLSA Practice Committee ensuring that the CAD file and georeferencing specification standards were achievable. ISC thanks all members of industry for their valuable contribution to this improvement.

CAD File Standards:

Plans submitted to ISC for approval must be digitally inspected prior to submission. Depending on the purpose of the plan, a CAD (Computer Aided Drafting) file is required for digital checking to be performed. Below are the standards for CAD files with details found in the Appendices:

1. CAD submissions must be AutoCAD dwg format. No other formats will be accepted.

2. Individual files are required for each submission. i.e. two subdivisions cannot be submitted on one digital CAD submission.

3. All CAD file submissions must be accompanied by a PDF or TIFF file derived from the dwg file. This image file must be a replica of the CAD file and will be the official plan of record, once approved.

4. CAD file data must be segregated according to the CAD Layer Chart found in Appendix A. CAD data that does not have an ISC layer defined in the CAD Layer Chart, must be drafted on a non-ISC layer of the user's choice.

5. CAD files must be georeferenced in accordance with Appendix B.

6. Line work must be topologically clean; without duplicates (on the same layer), gaps and overshoots.

7. The plan body must be drawn in model space.

8. Dimensions and angles not shown on the plan body due to limited space should be placed on the layer ISC_HID (not plotted on plan image).

9. Leader lines must be kept to a minimum and used only where necessary.

10. An area of at least 20mm but no more than 40mm in width around all edges of a plan shall be kept clear of any information. All plans must have a border.

Georeferencing Standards:

Georeferencing is the process of assigning a coordinate system to a set of data. This is accomplished by identifying a reference point on a plan & assigning georeferenced coordinates to that point. The CAD file is then rotated to match the appropriate grid orientation.

Legal Survey plans will be required to be georeferenced to the NAD83, CSRS datum UTM Extended Zone 13 in accordance with policy or Controllers' instructions issued under *The Land Surveys Act 2000 and corresponding regulation.*

The eventual goal is for the positional accuracy of georeferenced points to align with the Canadian Council on Geomatics resolution S05-10, for the coordinates at the 95% confidence level, a standard that has been adopted by other provinces:

- **0.05 metres in urban areas;
- 0.2 metres in rural areas; or
- 1.0 metre in remote areas.

**In the interim and until such time that we have acquired sufficient data as to the practicality of the 0.05m standard in "urban areas", the standard adopted in Saskatchewan will be:

- 0.10 metres in urban areas;

"Urban areas" are defined to the boundaries of the ¼ section containing an urban municipal limit (city, town, village, organized hamlet). Unorganized hamlets & smaller communities fall under the 0.2 meter standard for "rural areas".

Note: While these are the standards being requested it is understood that there will be situations: downtown core of a city, dense tree cover or possibly atmospheric disturbances etc. which may prohibit or make achieving these standards impractical at the time of the survey. When these situations occur we are asking that an explanation be included in the Survey Report with a statement as to the positional accuracy standard that has been achieved.

Methods:

The methods for determining the coordinates of the georeference point **in order of priority** are as follows:

1. **Ties to Provincial, Federal or municipal Active Control Stations or validated RTK networks.**

    - For a survey performed using Global Navigation Satellite System (GNSS) observations, the plan should be georeferenced to the GNSS derived coordinates. It is a requirement, that the surveyor improve the accuracy of the GNSS derived coordinates by using the PPP (Precise Point Positioning) Service from Natural Resources Canada www.nrcan.gc.ca or validated RTK networks (best practice standards yet to be determined).
        - o It is acceptable to place the base station on a point independent from the survey where the signal strength is most advantageous for the survey. The 2 georeference points

(close to extremities of the survey) would then be measured by RTK or static surveys in relation to the base station. This methodology should obtain the requested accuracies for the georeferenced points.

2. **Ties to any survey monuments on a previously georeferenced plan;**

   - Not restricted to the actual georeferenced survey monuments.

3. **Ties to existing geodetic control monument stations;**

   - For a survey tied to one or more Saskatchewan Survey Control Markers, the plan should be georeferenced to the observed coordinates (i.e. GNSS derived), as they more accurately reflect the true location of the survey. If georeferencing to the published coordinates, NAD83 (CSRS) there is currently a reduced list of approximately 150 Saskatchewan Control monuments considered acceptable to meet the required position accuracy standards for rural and remote areas. (See: the ISC Geodetic Control Coordinates page) Note: ISS monuments are not part of the 150 control monuments).

4. **Coordinates derived from the "cadastral parcel mapping system for Saskatchewan" or the SaskGrid (STS);**

   - Allowances exist to use coordinates derived from the most current version of the "cadastral parcel mapping system for Saskatchewan" or the SaskGrid (STS) (e.g. where GNSS equipment is not the tool of choice for the survey and methods 2 & 3 are not practical).

In the case of a Graphical Descriptive Plan Type II that is prepared by anyone (no field work required), priority 4 should be used.

NOTE: **Georeferenced coordinates to the NAD83 CSRS datum, UTM Extended Zone 13 are required for all plans of survey and descriptive plans (excluding textual descriptive plans).** Coordinates of the georeferenced survey will be published on either the plan of survey or 'hidden' in the intelligent CAD file submitted for approval for all four methods of georeferencing.   Please refer to Appendix B for details on publishing this evidence.

Appendix A: CAD Layer Standards

(Refer to Appendix F for further explanation, survey practice checks and illustration of each layer)

Note: Certain layer definitions segregate features within or outside of the approval line. If this requirement is not precisely specified then the layer must contain the feature both within and outside of the approval line.

ELEMENT:	LAYER:
Plan Information. (Details as defined in Appendix C must be adhered to.)	ISC_TBK
Legend (Details as defined in Appendix E must be adhered to.)	ISC_LEG
North Arrow	ISC_NAR
Key Plan	ISC_KEY
Approval Line	ISC_APP
Parcel Identifiers **within approval line** (includes lot numbers, parcel numbers, Streets, Street intersections, legal land descriptions i.e. remaining quarter sections, river lot numbers etc.) There must be one parcel identifier per parcel with the exception of condominium units.	ISC_PID
Parcel line work **within approval line** (includes lot, condominium units, parcel, quarter section, section, legal subdivision, river lot etc. line work)	ISC_PCL
Street and street intersection parcel closure lines **within approval line**	ISC_INT
Right-of-way line work for new right-of-ways (Feature Plans). (The right-of-way in it's entirety is required to be drawn on this layer even where boundaries are coincident with underlying surface features.)	ISC_RW
Extension numbers and area for affected land on applicable plans	ISC_AREA
Georeference Points (RP) and associated text on plan body i.e. RP1, RP2, Survey Monument and Survey Control Marker symbols and associated text and survey tie lines. (Symbols must be AutoCAD "Blocks" as defined in Appendix D.)	ISC_MON
Street name, lane, road allowance and walk way text and road, street, lane widths **within approval line**	ISC_STR
Radial lines for all curves	ISC_RDL
Dimensions, curve information, angles and associated lead lines (includes survey tie/connection dimensions)	ISC_DIM
Angles and dimensions **not shown** on plan because they are either repetitive dimensions or angles and dimensions recorded in details. The georeferencing coordinates can be placed on this layer if desired (See Appendix B).	ISC_HID (Not plotted)
Hydrographic features, names, flow arrows and notes to indicate how the bank was plotted	ISC_HYD
Block Numbers **within approval line**	ISC_BLK
Existing plan numbers and parcel line work **outside approval line** (includes lot, condominium units, parcel, quarter section, section, legal subdivision, river lot etc. line work)	ISC_OUT
Existing right-of-way line work and descriptors	ISC_RWD

Appendix B: Georeferencing Standards:

Georeferenced coordinates to the NAD83, CSRS datum UTM Extended Zone 13 are required for all CAD file submissions.   The submitting party has various options available to collect the coordinates – refer to Georeferencing Standards.   The CAD file shall be submitted using Grid or Ground distances and located so that a minimum of 1 RP matches the UTM Grid Coordinates with the 2nd RP point used for orientation.

Georeferencing Plan Requirements:
    The plan requirements for georeferencing are as follows:

Legend: (in addition to existing requirements)
- Reference Points are shown thus   ○ RP1   ○ RP2
- The datum used: NAD83(CSRS)
- The projection used: "UTM zone 13N extended"
- The coordinates of the georeferenced points to 3 decimal places. *(**Note:** These can be placed in the CAD file on **either** CAD layer ISC_LEG (plotted on the plan of record) or ISC_HID (not plotted on the plan of record).* i.e.
    - *RP1: Northing 6468886.497m; Easting 554871.317m*
    - *RP2: Northing 6465524.858m; Easting 556689.461m*
- A statement indicating that the RP coordinates were derived as of a specific date **OR** a statement indicating that the RP coordinates are current as of a specific date.
    - A statement indicating that the RP coordinates were derived as of a specific date:
        - This statement is to provide the date of when the RP coordinates were derived. Due to the time span between field work and post processing, the date may be different than the date the coordinate was used. This may be important for a large survey that spans months to complete.
    - A statement indicating the coordinates are current as of a specific date:
        - This statement is to indicate the date a coordinate was used; generally for existing monuments, either geodetic or a previously coordinated survey monument. This is important because the published value may change.
- A statement indicating the method of collecting the georeference point:
    - If derived from GNSS observations *OR*
    - If derived from a previously georeference survey plan
        - include Plan # *OR*
    - If derived from an existing geodetic control monument (Sask Survey Control Marker) Include point and coordinates
        - 785499: Northing 5525687.470m; Easting 617028.690m(3 decimal places)
        - 785539: Northing 5525906.360m; Easting 627465.320m (3 decimal places) *OR*
    - If derived from the SaskGrid or Cadastral

- Why can the coordinates of the georeferenced points be placed in the CAD file on the ISC_HID layer *(not plotted on the plan of record)* but the Legend statements must be shown on ISC_LEG *(plotted on the plan of record)*?
  - In discussions between the Controller of Surveys and the surveyor working group, it was decided that the RP coordinates would not have to be shown on the plan image. However, they felt it was important to show the relevant information pertaining to those coordinates such as datum, projection, and method derived as it ensures the plan is in accordance with policy issued under The Land Surveys Act 2000 and corresponding regulation. Listing the methods for collecting the coordinates also determines the positional accuracy that has been achieved for that particular survey.

Body of the Plan:

• Two georeferenced points using the prescribed symbol (an un-filled circle with a recommended plot radius of 2 mm accompanied by the unique text identifier "RP1" and "RP2". The symbol must be a block called 'RP' – see Appendix D).

> **Note:** The centre of the symbol in the CAD file must digitally match the grid coordinate of RP1 georeference point shown on the plan.

• If a georeferenced point is outside the main body of the plan the practitioner must:

> 1. Place the symbol in the correct georeferenced position and on the prescribed layer in the CAD file and label with the associated text.
> 2. Show a copy of the symbol on the main body of the plan with a broken line but on an undefined layer.

Surveyor's Report:

Where the coordinates of the georeference points (RP's) are not being shown on the plan of record, the surveyor has the option to include the coordinates in the survey report in order to make the coordinates available to other surveyors. Where the positional accuracy standards requested are unattainable at time of survey (i.e. downtown core of a city, dense tree cover or possibly atmospheric disturbances etc.) provide an explanation as to the reason and state the positional accuracy standard that has been achieved.

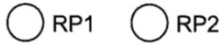Provide a brief explanation of the survey methodology that was used, highlighting any anomalies.

Appendix C: Plan Information Layout

Plan information must **adhere to this order** and key words must be used for "**By**", "**Date**" and "**Scale**" as noted below in **RED BOLD**.

- Plan Type
- Land (GIS) Layer and Plan Purpose
- Reference to affected or subdivided parcels where applicable
- Location
- Surveyor
- Survey Date
- Scale

EXAMPLE 1	EXAMPLE 2
PLAN OF SURVEY SHOWING FEATURE RIGHT OF WAY FOR WATERLINE THROUGH PARCEL B, PLAN No. 98SE09839 AND THROUGH PARCEL U, PLAN No. 101969185 NW 1/4 SEC 21, TWP 13, RGE 5, W2 Mer KIPLING, SASKATCHEWAN **BY**: JOHN DOE, SLS **DATE:** OCTOBER, 2012 **SCALE:** 1:1000	Plan of Survey Showing SURFACE SUBDIVISION Of Part Of N.W. 1/4 Section 7 Twp.16 - Rge.26 – W.3Mer. R.M. of FOX VALLEY NO. 171 Saskatchewan **BY:** JANE DOE, S.L.S **DATE:** November 12, 2010 **SCALE:** 1:5000

Appendix D: Survey Control Marker, Survey Monument Requirements and Reference point symbols

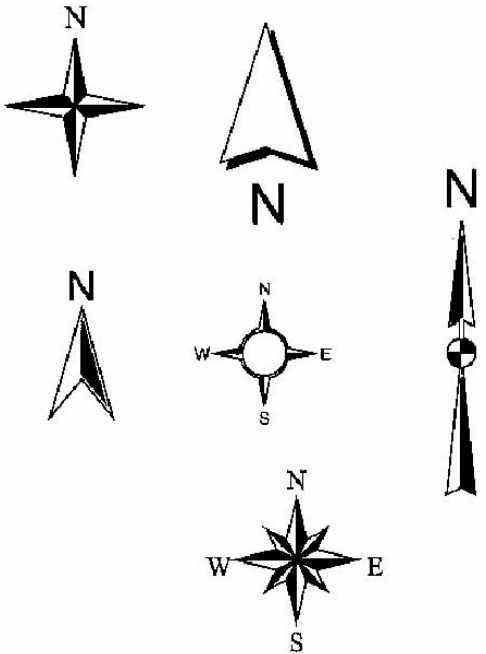| Block Name	Symbol	Description
FIP	◆	Found Iron Post
PLIP	●	Planted Iron Post
SCM	▲	Survey Control Marker
RP	◯ RP1 ◯ RP2	Reference Point*

*The symbol should be 'empty' and shown over the Found or Planted symbol. Reference Points should be located where a monument physically exists. This provides the option to use the same georeferenced point in the future.
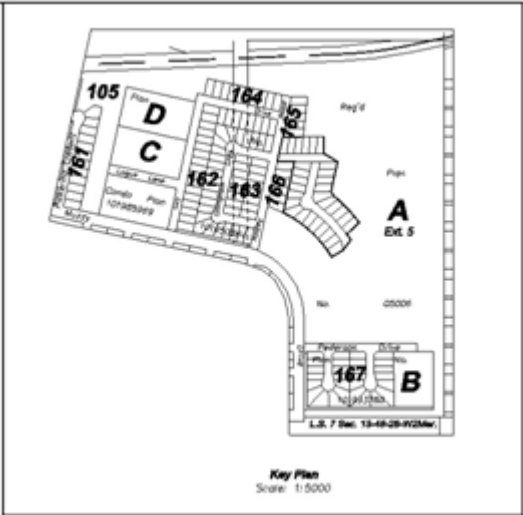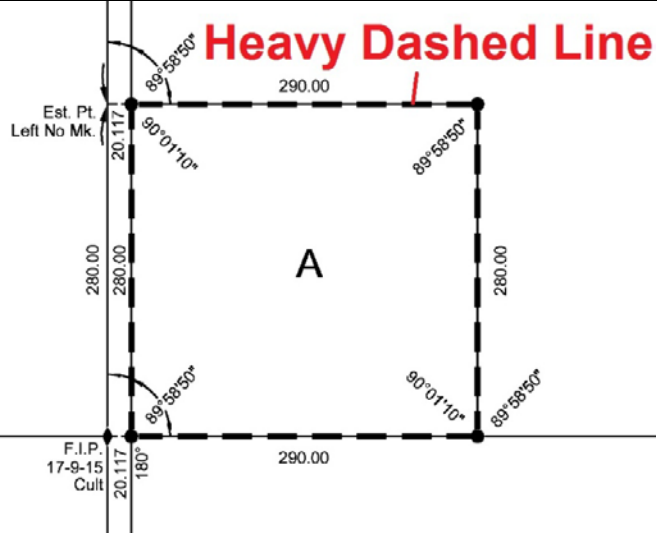
Appendix E: Plan Legend Standards

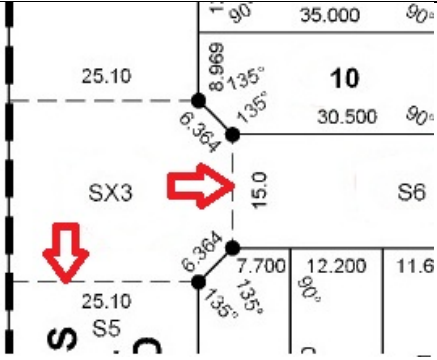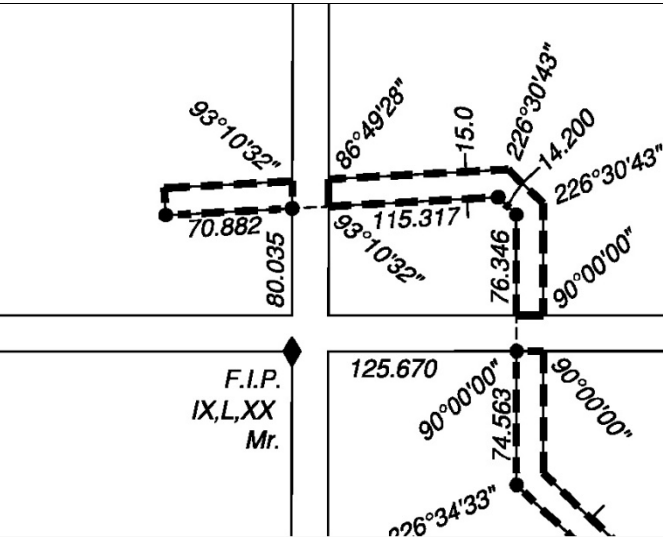| ID	Standard Legend Content. Failure to use these standards could result in errors and warnings in plan checking.
1	Standard road allowances on this plan are ___ metres in width
2	Measurements are in metres and decimals thereof
3	Measurements are in metres and decimals thereof and are copied (DPII plans)
4	The Unique Identifier of S (number) has been stamped on all established standard iron posts
5	Area to be approved is outlined by a heavy dashed line
6	All parcels within the line of approval have an extension 0 unless otherwise shown
7	The extensions of all parcels affected by this feature are 0 unless otherwise shown
8	New Right of Way limits are straight lines unless otherwise shown
9	Standard iron posts (or Monuments established as the case may be) along the right of way limit are marked "RW" (or the initial letters of the words composing the name of the company that has the interest in the right of way) and shown thus…
10	Width of Right of Way is ___ unless otherwise shown
11	Standard iron posts (or Standard Monuments or Monuments as the case may be) planted are shown thus…..
12	Standard iron posts (or Standard Monuments or Monuments as the case may be) found are shown thus…..
13	All lot corners not marked by a standard post are marked by 0.013 x 0.450 small iron posts
14	If water boundaries are shown, a statement is required as to how the banks were plotted unless it is clearly from an existing plan of survey
15	The bank is taken as the boundary, for definition of bank see Section 32 of The Land Surveys Regulations, 2000
16	Control Survey monuments and numbers (found or planted) are shown thus _____ (number)
17	The Datum used: NAD83(CSRS)
18	The Projection used: UTM Zone13N extended
19	RP1: Northing; Easting in meters to 3 decimals RP2: Northing; Easting in meters to 3 decimals
20	Saskatchewan Control Monuments tied into: monument #; coordinates; Northing; Easting in meters to 3 decimals
21	A chart showing the adjusted UTM coordinates for all photo identified points used for control
22	A statement indicating that the RP coordinates were derived as of a specific date **OR** a statement indicating that the RP coordinates are current as of a specific date.
23	Reference Points are shown thus
24	A statement indicating the method of determining the georeference coordinates. (Ex. "Georeferenced points derived from ………")

Appendix F: Business Rule/CAD Layer Matrix

Layer	Feature	Survey Practice/Layer Purpose	Example Illustration
ISC_TBK	Plan Information	**To extract and validate information:** 1. Plan Type (Survey, Descriptive Plan Type I or Descriptive Plan Type II) 2. Plan Purpose (i.e. Subdivision, Utility Easement) 3. GIS Land Layer (Surface, Mineral or Feature) 4. Survey end date (Month/Year from extraction) 5. Surveyor's Name 6. Scale 7. Location (Urban, Rural, etc) **Survey Practice Tests:** 1. Does the scale conform to plan standards of 1:10000, 1:5000, 1:2000, 1:1000, 1: 500, 1:200, 1:100 or has a nonstandard scale been approved by Controller of Surveys. 2. Test that extracted values for Plan Type, Plan Purpose, GIS Layer and Location are valid. 3. Check that Survey date is a valid month and year in the past.	PLAN OF SURVEY SHOWING FEATURE RIGHT OF WAY FOR WATERLINE THROUGH PARCEL B, PLAN No.98SE09839 AND THROUGH PARCEL U, PLAN No. 101969185 NW 1/4 SEC 21, TWP 13, RGE 5, W2 Mer KIPLING, SASKATCHEWAN BY: JOHN DOE, SLS DATE: OCTOBER, 2012 SCALE: 1:1000

ISC_LEG	Legend	**Survey Practice Tests:** 1. Does a legend exist? 2. Does the legend contain required content based on plan purpose? 3. RP coordinates in the legend are used to confirm CAD file georeferencing Note: Legend must contain standardized wording as per Appendix E.	**LEGEND:** Standard Road Allowances on this plan are 20.117 metres in width. Measurements are in metres and decimals thereof. The Unique Identifier of S0XX has been stamped on all established standard iron posts. Area to be approved is outlined by a heavy dashed line. All parcels within the line of approval have an extension 0 unless otherwise shown. Standard iron posts found are shown thus Standard iron posts planted are shown thus Reference Points are shown thus　　RP1　RP2 The Datum used: NAD83(CSRS) The Projection used: UTM Zone13N extended Geo-referenced points derived from GNSS observations RP coordinates were derived on August 11, 2014 RP1: Northing 5654162.625; Easting 701013.721 RP2: Northing 5654194.330; Easting 701818.898
ISC_NAR	North Arrow	**Survey Practice Test:** 1. Does a North Arrow exist?	

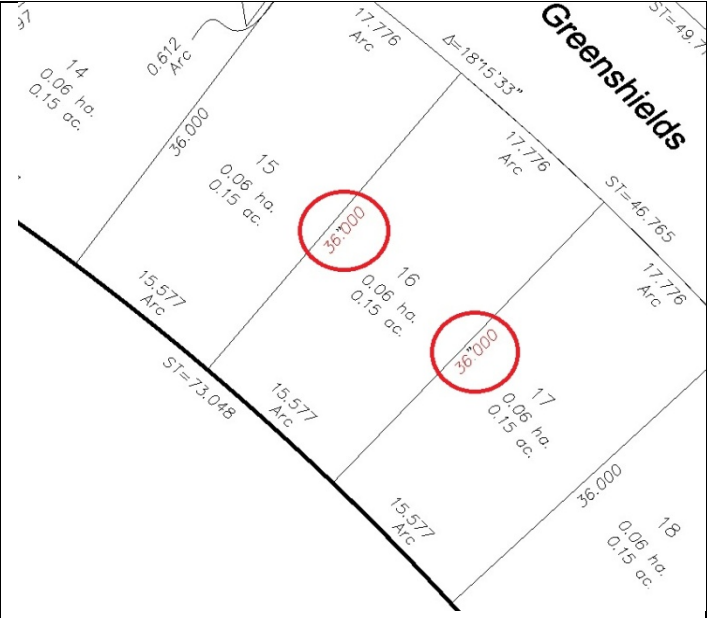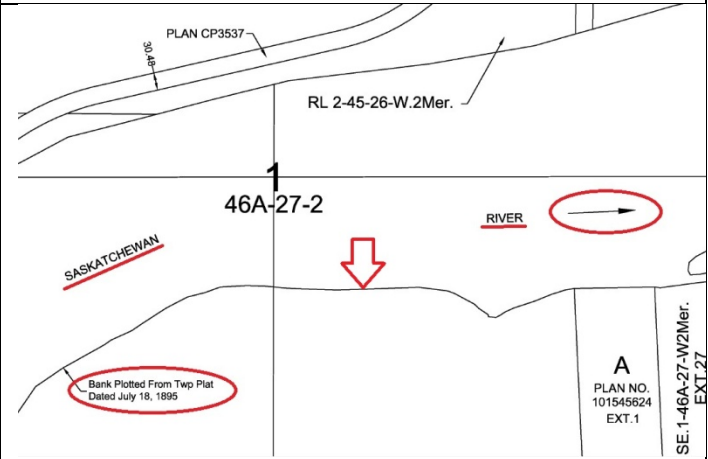| ISC_KEY	Key Plan	**Survey Practice Test:** 1. Does a Key plan exist where required?	
ISC_APP	Approval Line	**Survey Practice Test:** 1. Does the approval line exist?	

ISC_PID	Parcel Identifiers **within approval line** (includes lot numbers, parcel numbers, Streets, Street intersections, legal land descriptions i.e. remaining quarter sections, river lot numbers etc.) There must be one parcel identifier per parcel with the exception of condominium units.	**Survey Practice Tests:** **To extract and validate information to load into online form:** 1. Parcel Counts. Please note that each individual text string on the ISC_PID layer is counted as a parcel. i.e. "Municipal Reserve MR1" should be one continuous text string to be counted as one parcel. 2. To provide a 'closest to parcel identifier' for the dimension and angle checker results.	
ISC_PCL	Parcel line work **within approval line** (includes lot, condominium units, parcel, quarter section, section, legal subdivision, river lot etc. line work)	**Survey Practice Tests:** 1. Does the line work create closed parcels (in conjunction with Layer "ISC_INT")? 2. Dimension/Angle/Parcel Closure test – does geometry drawn match distances and angles recorded on the plan?	

ISC_INT	Street and street intersection parcel closure lines **within approval line.**	**Survey Practice Tests:** 1. Does the line work create closed parcels (in conjunction with Layer "ISC_PCL")? 2. Dimension/angle/parcel closure test – does geometry drawn match distances and angles recorded on the plan?	
ISC_RW	Right-of-way line work for new right-of-ways on **Feature Plans**. (The right-of-way in it's entirety is required to be drawn on this layer even where boundaries are coincident with underlying surface features.)	**Survey Practice Tests:** 1. Does the line work create closed feature parcels? 2. Dimension/angle/parcel closure test – does geometry drawn match distance/angle recorded on the plan?	
ISC_AREA	Extension numbers and area for affected lands	**Survey Practice Tests:** 1. Does the total area of the right of way polygons equal the total affected area denoted on plan? 2. User to confirm that the correct extension numbers have been used. The visual map function will enable the user to validate this.	**N.W.1/4 SEC.4-14-19-3 Ext.0** Area in R/W = 0.57 ha

ISC_MON	Georeference Points (RP) and associated text on plan body i.e. RP1, RP2, Survey Monument and Survey Control Marker symbols and associated text and survey tie lines. Symbols must be AutoCAD "Blocks" as defined in Appendix D.	**Survey Practice Tests:** 1. Does RP1 point match the spatial location indicated in the legend or on layer ISC_HID? **To extract and validate information to load into online form:** 1. Extract primary corners 2. Check if plan is tied to geodetic control 3. Check if plan is monumented.	RP1 F.I.P. 5-14-19 Mr.
ISC_STR	Street Name, Lane, Road Allowance and Walk Way Text and Road, street, lane widths **within approval line**	**Survey Practice Tests:** 1. Perpendicular widths are shown twice for all roads, streets and lanes within approval area (Warning only). 2. User to confirm that the street names are correct. The visual map function will enable the user to validate this.	AVIATOR PLACE

ISC_RDL	Radial lines for all curves	**Survey Practice Tests:** 1. Radial lines exist at the beginning and end of all curves within area of interest.	
ISC_DIM	Dimensions, curve information, angles and associated lead lines (Includes survey tie/connection dimensions)	**Survey Practice Tests:** 1. To confirm distances are shown on all new boundaries. 2. Dimension/angle/parcel closure test – does geometry drawn match distance/angle CAD text?	

ISC_HID (Not plotted)	Angles and dimensions **not required** on plan body. This includes repetitive dimensions, angles and angles and dimensions recorded in details.

The georeferencing coordinates can be placed on this layer if desired (see Appendix B) i.e. RP1: Northing 6468886.497m; Easting 554871.317m | **Survey Practice Tests:**
1. Dimension/angle/parcel closure test – does geometry drawn match distance/angle CAD text? | |
| ISC_HYD | Hydrographic features, names, flow arrows and notes to indicate how the bank was plotted | **Survey Practice Tests:**
1. To determine if hydrographic features exists on plan. This notification will prompt the plan examiner to review traverse note. | |

ISC_BLK	Block Numbers **within approval line**	**Survey Practice Tests:** 1. To ensure that block identifiers exist within line of approval.	
ISC_OUT	Existing plan numbers and Parcel line work **outside approval line** (includes lot, condominium units, parcel, quarter section, section, legal subdivision, river lot etc. line work)	**Survey Practice Tests:** 1. To determine that all plans are shown for the parcels adjacent to the survey for geographical location. The visual map function will enable the user to validate this.	

| ISC_RWD | Existing right-of-way line work and descriptors | **Survey Practice Tests:**

1. To determine that all feature plans filed in the Land Surveys Directory are shown as dashed lines. The visual map function will enable the user to validate this. | |