Figure 3

Adelaide Wind Energy Centre

Project Area and Water Bodies
(Northern Project Area)

Legend

- Project Area (120m)
- Non-Water Body
- Water Body
- Turbine
- MET
- Access Road
- Collector System (Underground Cabling)
- Transmission Line (Aboveground Cabling)
- Project Location
- Staging Area
- Substation
- Operations & Maintenance Buildings
- Existing Transmission Line
- Railroad
- Permanent
- Intermittent
- Waterbody
- Watershed
- Provincially Significant Wetland (PSW)
- Other Wetland
- ANSI, Life Science
- ANSI, Earth Science

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

Project: 1230
Date: August 20, 2012

NAD83 - UTM Zone 17
Scale: 1:50,000 (11x17")

0 1,000 2,000 3,000 Metres

N

Path: X:\1230_AdelaideWindFarm\NRSI_1230_AdelaideWF_PotentialAquaticPoints_Fig3_50K_2012_08_20_KEB.mxd

2.0 REA Regulations

Ontario Regulation (O. Reg.) 359/09 – *Renewable Energy Approvals* Under *Part V.0.1 of the Act*, (herein referred to as the REA Regulation) made under the *Environmental Protection Act* (*EPA*) identifies the requirements for the development of renewable energy projects in Ontario. In accordance with REA regulations, the proposed Adelaide Wind Energy Centre, classified as a Class 4 wind facility, is required to complete a REA submission.

Section 40 of the REA Regulation state that "no person shall construct, install or expand a renewable energy generation facility as part of a renewable energy project at a project location that is in any of the following locations":

1. within 120 meters of the average annual high water mark of a lake, other than a Lake Trout lake that is at or above development capacity;
2. within 300 meters of the average annual high water mark of a Lake Trout lake that is at or above development capacity;
3. within 120 meters of the average annual high water mark of a permanent or intermittent stream; or
4. within 120 meters of a seepage area.

This however does not apply if the applicant submits a report that:

1. identifies and assesses any negative environmental effects of the project on a water body referred to in paragraphs 1 to 4 (above) and on land within 30 meters of the water body;
2. identifies mitigation measures in respect of any negative environmental effects mentioned in clause (1);
3. describes how the environmental effects monitoring plan addresses any negative environmental effects mentioned in clause (1); and describes how the construction plan report prepared in accordance with Table 1 of the REA addresses any negative environmental effects mentioned in clause (1).

3.0 Summary of Records Review

In accordance with the REA Regulation, NRSI has completed a records review for the proposed Adelaide Wind Energy Centre project location and surrounding 120m (NRSI 2012a). In many cases a considerably larger study area of 1km (and beyond) was examined to ensure all natural features and wildlife habitats in the vicinity of the proposed wind farm were considered. This records review included correspondence with regional and provincial agency staff, and a review of several available online and published resources. The results of this records review have been summarized in Table 1 below. Full details are provided in the complete report (NRSI 2012a).

Table 1. Summary of Records Review of the Adelaide Wind Energy Centre

Criteria	Associated Water Body Features
i. In a water body	The records review has identified 38 potential water bodies to be overlapping the project location, including 37 within the large Ausable River watershed and 1 within the Sydenham River watershed. These overlaps typically represent proposed crossing locations for access roads, transmission line or cabling. All of these water bodies represent potential permanent or intermittent watercourses. All of which are designated as warmwater fisheries containing warmwater baitfish species, with the exception of Lenting Drain which is classified as a cool/coldwater watercourse. Each of these potential water bodies will be examined in more detail during the site investigation phase of this project.
ii. Within 120 m of the average annual high water mark of a lake, other than a lake trout lake that is at or above development capacity	None
iii. Within 300 m of the average annual high water mark of a lake trout lake that is at or above development capacity	None
iv. Within 120 m of the average annual high water mark of a permanent or intermittent stream	The records review has identified 54 potential water bodies located within 120m of the project location, including 47 within the large Ausable River watershed and 7 within the Sydenham River watershed. All of these water bodies represent potential permanent or intermittent watercourses. Most of these water bodies are designated as warmwater fisheries, with the exception of the Lenting Drain which is classified as cool/coldwater.
iv. Within 120 m of a seepage area	None

4.0 Summary of Site Investigation

Comprehensive site investigations for the Adelaide Wind Farm project were undertaken by NRSI biologists on September 19 and 22, November 2 and 3, 2011 and March 30, 2012. These site investigations included site-specific habitat assessments of water bodies throughout the project area. In areas where property access was not granted or aquatic resources were located considerably closer to the road than to project components, site investigations were conducted from nearby roadside locations.

Of the 54 potential water body features identified within the study as part of the Records Review, a total of 23 were confirmed as water bodies based on site investigation findings. No lakes, Lake Trout lakes, or seepage areas were identified within 120m of the Adelaide Wind Energy Centre project location. A summary of the site investigations findings is provided in Table 2 below.

Table 2. Summary of Water Body Site Investigations within the Adelaide Wind Energy Centre Project Area

Criteria	Associated Water Body Features
i. In a water body	Site investigations have confirmed the presence of 19 water bodies overlapping the project area, all of which are within the Ausable River watershed. These overlaps represent proposed crossing locations for access roads, transmission line or cabling. All of these water bodies represent permanent or intermittent watercourses. All of which are designated as warmwater fisheries containing warmwater baitfish species, with exception of the Lenting Drain which is classified as a cool/coldwater system. Each of these potential water bodies will be discussed in detail as part of the Environmental Impact Study.
ii. Within 120 m of the average annual high water mark of a lake, other than a lake trout lake that is at or above development capacity	None
iii. Within 300 m of the average annual high water mark of a lake trout lake that is at or above development capacity	None
iv. Within 120 m of the average annual high water mark of a	Site investigations have confirmed the presence of 23 water bodies within the project area, all of which are

Criteria	Associated Water Body Features
permanent or intermittent stream	within the Ausable River watershed. Most of these water bodies are designated warmwater fisheries, with the exception of the Lenting Drain which is classified as cool/coldwater system. Each of these water bodies will require the completion of an Environmental Impact Study
iv. Within 120 m of a seepage area	None

The results of this site investigation will be used, in conjunction with the records review, to identify potential impacts associated with the proposed development activities for the Adelaide Wind Energy Centre.

5.0 Description of Proposed Undertaking

The following sections provide information pertaining to the design, construction, operation, and decommissioning activities associated with the proposed Adelaide Wind Energy Centre.

5.1 Design

The proposed design layout includes the installation of up to 38 turbines, as well as associated supporting infrastructure such as above and below ground electrical collector cabling, turbine access roads, substation transformers, switching station, transmission line and associated buildings are also proposed.

The proposed turbines include 38 GE 1.6-100 (1.62MW) wind energy generating turbines for a total installed capacity of up to 61.56MW. Each turbine is to be mounted on a steel reinforced concrete foundation measuring 400m^2 in area and equipped with a transformer located outside the base of the tower. The total rotor diameter of the turbine is 100m, resulting in a swept area of 7,854m^2, and is designed to operate at between 9.75 and 16.18 revolutions per minute (rpm). The turbine rotor and nacelle are mounted on top of an 80m tubular tower which is manufactured in sections from steel plate (GLGH 2012).

Energy generated by the wind energy project will be collected via 34.5kV underground and above ground cabling and directed to a substation that will step-up the voltage from 34.5kV to 115kV. A project-owned 115kV transmission line will then travel north to a proponent-owned switchyard and from there will connect to a Hydro One 500kV transmission line via a Hydro One substation that will step-up the voltage to 500kV (GLGH 2012).

Three supporting facilities will be required to be constructed. They include a substation (which includes an operation and maintenance building), switchyard, and point of interconnection (GLGH 2012).

Access roads will be constructed to allow for access to turbines and facilities. The roads will be designed to a post-construction width of 6m. Access road construction will include clearing top-soil to a depth of 300-600mm. Roads will be topped with clean type 'A' or Type 'B' gravel (GLGH 2012).

Specific design details regarding water body crossing structures at access roads are not available at this time, although, consultation with OMNR, DFO, and the local Conservation Authority will occur during the design process.

5.2 Construction

The construction phase of the project will involve:

- turbine assembly and installation;
- installation of electrical collector cabling (below ground and overhead);
- installation of transmission line;
- creation of new access roads;
- installation of associate facilities (substation, switchyard and point of interconnection) and,
- installation of temporary construction components (i.e. laydown areas, storage areas etc.)
- installation of MET tower

Based on current layouts, vegetation clearing, tree removal grubbing, and grading will occur in select locations in the project area to accommodate access roads, turbines, crane pads, lay-down areas, and associated buildings. A detailed impact assessment associated with vegetation removal is provided in the Natural Heritage Assessment Environmental Impact Study Report (NRSI 2012c).

A total of up to 38 operational turbines will installed as part of the Adelaide Wind Energy Centre project. As part of the turbine erection, laydown areas and crane pads will be placed around the base of the turbine. Within this area, the ground will be leveled. The crane pads, measuring approximately 15m by 35m, will require the removal of 600mm of topsoil and addition of clean, compacted, gravel. Individual turbine laydown areas will measure 120m by 120m.

Electrical collector cabling installed below ground on private lands as well throughout the roadside collector cabling system will be installed by way of open cut trenches. This is with the exception of one location where directional drilling will occur. This location is south of turbine T7. Drilling will occur at this location to extend the cabling beneath a water body and woodland in order to avoid direct impact to these features. Other locations of drilling are likely, but not confirmed at this time. These locations are expected to include water body crossings where working in dry conditions is not possible so that direct impacts to the feature are avoided. Specific locations for drilling will be selected during the detailed design, permitting and approvals phase of the project.

The open cut trenches will be approximately 0.9m deep, and all excavated soil will be retained and used to fill the trench after cables have been laid. Overhead cabling is proposed along the length of the transmission line, extending from the Adelaide substation, to the switchyard along Kerwood Road, then along Elginfield and Nairn Roads to the point of interconnection. Overhead cabling will either be mounted on existing or new poles that will be between 18-30m tall. Poles will be installed using augered holes that are approximately 1-2m deep. It is anticipated that the 115 kV electrical transmission line will be mounted on existing hydro poles or on new hydro poles (GLGH 2012).

Access roads will be constructed to be 11m wide during the construction phase to allow for large cranes. After construction, these roads will be reduced to a final post-construction width of 6m. Access road construction will include clearing top-soil to a depth of 300-600mm. Roads will be topped with clean type ‘A’ or type ‘B’ gravel.

Three buildings will be constructed as part of the Adelaide Wind Energy Centre development. These include the substation (which includes an operation and maintenance building), switchyard, and point of interconnection.

A 4ha (10 acre) site will also be constructed for the temporary storage of construction material during the projects construction phase.

Detailed construction methods are provided in the Construction Plan Report (GLGH 2012).

5.3 Operation

Wind farm operation activities include daily monitoring of wind turbines, un-scheduled and scheduled maintenance activities, and monitoring of meteorological data.

No groundwater or surface water supplies will be used as part of the operation of the facility as municipal water supplies will be accessed (GLGH 2012). A septic bed will be constructed for the disposal of sewage from the operations and maintenance building (GLGH 2012). No permanent sediment control features or storm water management facilities will be implemented. In addition, there are no areas where waste, biomass and source separated organics are stored, handled, processed or disposed of during the operation of wind energy centre.

The Application of herbicides may also occur within the project area to help control vegetation growth beneath turbines and/or along above ground cabling routes (i.e. transmission lines).

5.4 Decommissioning

Project components are expected to be in service for the duration of the operational phase. Following the operational phase, a decision will be made to extend the life of the facility or to decommission. Decommissioning would entail the dismantling and removal of project infrastructure associate with the Adelaide Wind Energy Centre and restoring the land to a use similar to pre-construction activities.

With decommissioning, 3 buildings associated with the Adelaide Wind Energy Centre, including the substation, switchyard, and point of interconnection, would all require demolishing and removal.

As part of the turbine removal, laydown areas and crane pads will be re-established around the base of the turbine. Within this area, the ground may require leveling. Following the removal of turbines, the land is expected to return to the land use existing prior to turbine installation. For each of the turbines in the Adelaide Wind Energy Centre, this land use would be agricultural activities. Removal of turbine components will also include the removal of the top 3 feet of the underground foundation.

During the decommissioning of the project, the underground cabling will be cut, with ends buried at approximately 1m deep, and will be left in place to avoid further disruption to potential wildlife habitats or agricultural activities. The same approach will be taken at the single location of horizontal direction drilling to avoid potential environmental impacts associated with removal of cabling below significant natural features, wildlife habitats, or aquatic resources.

As part of this project, overhead cabling will be installed along the length of the transmission line, extending from the Adelaide substation, to the switchyard along Kerwood Road, then along Elginfield and Nairn Roads to the point of interconnection. Upon decommissioning of the project, these lines will be dismantled and removed. All poles and cabling solely associated with this project will be removed at the end of the project life, and land will be restored to a condition similar to that observed during pre-construction.

It is envisioned that all access roads and associated water body crossing structures will be left in place, although it is at the discretion of the landowners.

6.0 Impact Assessment

6.1 Approach to Impact Assessment

For the purposes of this report, the analysis of potential impacts has been divided into two categories. Firstly, generalized potential impacts on water bodies related to each project phase including construction, design, operation and decommissioning. Secondly, specific impacts to each water body identified within the project area that considers the site specific features and functions of the water body as well as the proposed works. No lakes, Lake Trout lakes or seepage areas are located within the project area. These impacts are grouped by water body feature type, as identified by O. Reg. 359/09, s. 30 and include permanent or intermittent streams.

This approach allows for general impacts to water body features as it relates to project construction, design, operation and decommissioning to be identified and addressed clearly and concisely.

All identified impacts are discussed in this section assuming no mitigation measures are applied, therefore, are described as a "worst case scenario" for impacts to water bodies. Recommendations to mitigate identified impacts as well as monitoring of effectiveness of these measures are discussed in Section 7.0.

6.2 Generalized Project Phase Impacts

If not mitigated appropriately, impacts to water bodies have potential to arise due to the nature of development and construction activities. These impacts may affect surface water quality, fish, fish habitat, benthic organisms, and stream hydrology. The level of impact ranges from temporary disturbance to permanent loss or impairment.

Impacts associated with each project phase including design, construction, operation, and decommissioning are discussed below in Sections 6.2.1. through 6.2.4, respectively. Specific impacts associated with each water body within the project area are discussed in Section 6.3. A summary of general project phase impacts are present in Table 8 in Section 8.0.

6.2.1 Design

Impacts associated with wind energy project design are related to 1) project layout and 2) the design of project components.

Project layout will dictate which water bodies will be directly impacted based on project component placement and the level of risk associated based on the proximity of the project component to the water body feature (i.e. 25m away versus 100m away). It is inferred that the greater distance a water body is away from a project component, the less risk for impacts to the feature, although, topography (slope to the water body), the permeability of soils, and the density of vegetation and/or ground litter (i.e. dead grass, leaves, twigs, and logs) are also all factors in the level of risk of impacts to water bodies. NRSI worked closely with the proponent throughout the REA reporting process to identify water bodies and avoid direct impacts wherever possible.

With respect to project components occurring within a water body, the REA Regulation sets clear guidelines as to where wind farm development is acceptable. In the case of Class 4 wind farm facilities, like the proposed Adelaide Wind Energy Centre project, the development of turbines and transformer stations is prohibited within and 30m from all water bodies. All other ancillary project components including transformer lines and access roads can occur at any distance from, including within, a water body if it is demonstrated that it will result in no negative environmental effects, through the completion of an impact study.

Within the proposed Adelaide project area, electrical collector cabling traverse intermittent/permanent watercourses and therefore are occurring within these features. Design related impacts resulting from project components occurring within these water bodies are discussed below.

A common impact to all water bodies is the alteration of local drainage patterns. This impact is directly related to project layout, stormwater management design, and grading plans. Alteration of drainage patterns has the potential to affect all water bodies occurring within the associated drainage catchment area(s) and is not exclusive to the project area.

Alteration of drainage patterns occurs through a variety of project related activities including the re-grading of land, removal of surrounding forested vegetation, increase in impervious surfaces with the installation of turbine pads, transformer stations and access roads as they are constructed with impervious surfaces (i.e. concrete and asphalt) as well as the implementation of stormwater management measures (i.e. installation of roadside ditches).

Alteration of drainage patterns can cause a variety of impacts to water bodies. This includes changes to watercourse flow (increase or decrease), changes to thermal characteristics of a water body, more specifically, warming of a feature through increased surface water run-off contributions, decreased groundwater base flow, increases and decreases in water levels of seepage areas and lakes. Decreased infiltration to key areas (areas of recharge) due to newly impervious cover interrupts the natural water cycle causing a decrease in infiltration and soil attenuation of precipitation. Additionally, an increase in impervious cover facilitates runoff, which if it occurs down a steep slope (i.e. a valley feature), could increase potential for erosion and downstream sedimentation.

Specific impacts as a result of alteration of drainage patterns will need to be addressed at the detailed design, permitting and approvals phase. As the proposed project location layout considers proximity to water bodies by limiting interference with these features, in addition to utilizing existing access roads where possible, it is anticipated that alterations to drainage patterns will be minimal.

Intermittent/Permanent Watercourses

Design related impacts to watercourses are associated with the specific location of the proposed crossing in the feature as well as the proposed crossing structure type, method, or structure. Currently no water bodies are crossed by any new access roads, therefore, no new water crossing structures are required. Although, additional water crossing locations situated along existing municipal roads may require upgrades, and therefore, new crossing structures. However, the need for these upgrades and exact locations (if any) must be determined through consultation with the contractors completing this work. It is expected that any culvert upgrades required along existing municipal roads will follow the same mitigation measures proposed for new crossing locations. Locations of electrical collector cabling and road crossings, if not selected appropriately, have potential to impact key habitat features (i.e. such as refuge pools, spawning beds etc.). Details of proposed crossing locations including structure and specific locations are not known at this time and will be addressed during the detailed design phase of the project. Therefore, impacts on specific key habitats cannot be identified.

Depending on crossing structure design, some structures may result in the permanent loss and alteration of fish habitat caused by physical changes to the stream channel, streambed and riparian vegetation through filling, straightening and enclosing a watercourse within the crossing area. In addition to permanent loss of fish habitat, enclosure of a watercourse will result in the alteration of the feature with the loss of natural substrates, loss of in stream habitat (structure/cover), and alteration of food supply (i.e. benthos, macrophytes).

Alterations to the hydrology (flow volume and dynamics) of a watercourse is possible through the positioning and sizing of the structure. Impacts from altering hydrology are associated with the alteration of existing morphological habitats (i.e. riffles), potential for flooding and increased erosion potential. Barriers to fish passage are also possible through the improper placement of a culvert structure that results in perched conditions (elevated above the watercourse) that fish are unable to pass. Barriers to fish passage can potentially limit the normal localized movement and migration patterns of fish species. Loss of riparian habitat through the development or alteration of an existing crossing is also possible. This would result in a change to in-stream shading and cover, furthermore reducing watercourse function.

Any loss in the productive capacity of fish habitat as a result of changes to the physical structure, substrate, type and quantity of cover, vegetation, and flow volume and dynamics are considered harmful alteration, disruption or destruction (HADD) to fish habitat and are prohibited under the federal *Fisheries Act (1986)*.

Details of proposed crossing structures (new or upgrades) along existing municipal roads will be addressed during the detailed design phase of the project, if required. At that time, specific impacts will be determined based on final design specifications.

6.2.2 Construction

Potential impacts identified for the construction phase of the Adelaide Wind Energy Centre are based on the understanding of project works described in Section 5.2, and include the following project activities:

- turbine assembly and installation;
- installation of electrical collector cabling (below ground and overhead);
- installation of transmission line;
- creation of new access roads;
- installation of associate facilities (substation, switchyard and point of interconnection) and,
- installation of temporary construction components (i.e. laydown areas, storage areas etc.)
- installation of MET tower

Potential for impacts to water bodies during this project phase is generally associated with the length of the construction window (i.e., days, weeks, months); however, un-mitigated impacts have the potential to cause lasting effects beyond the construction window, or permanent impacts that will be evident during the operational phase of the project. In addition, as mentioned in the design related impacts section, project layout will dictate the level of impact that a water body has potential to be exposed to during construction based on proximity of a project component to a water body feature (i.e. 100m away versus 25m away). It is inferred that the greater distance a water body is away from a project component, the less potential for impacts to the feature. The slope to the water body, the permeability of soils, and the density of vegetation and/or ground litter are also factors in the level of impact risk present. The method of construction selected will also dictate the type of impacts that are possible as well as the degree of impact, as is the case with the installation and connection of electrical collector cabling. An open-trench method (as proposed for this project) has the potential for increased risk of impacts at water crossing locations. Trenchless technology (horizontal directional drilling) would result in minimal impact both directly and indirectly. Directional drilling is currently proposed at water body location 24 (Figure 2), but may occur at additional water body locations. These locations will be determined in the detailed design, permitting and approvals phase.

Potential construction related impacts to water bodies have been identified and grouped by the following discussions:

- erosion and sedimentation;
- contaminant spills
- in-water work,
- dewatering;
- soil compaction;
- construction debris; and
- drilling

6.2.2.1 Erosion and Sedimentation

Disturbance of the project site as a result of vegetation clearing and grubbing, topsoil and subsoil stripping, grading, use of heavy machinery, and soil stockpiling all have the potential to increase erosion in areas directly at or adjacent to water bodies, resulting in movement of sediment-laden runoff into receiving watercourses. Precipitation and thaw events, where runoff is in contact with these exposed areas, have increased potential for erosion and sedimentation.

Soil compaction also has potential to occur as a result of heavy machinery and the stockpiling of heavy materials (i.e. soils) in the project area. Soil compaction can greatly reduce the permeability of soils and affect their ability to retain water during rain/snow melt events. This will result in an increase in surface water run-off which will ultimately increase the erosion potential and the amount of sediment being transported into adjacent water bodies.

The removal of riparian and buffer vegetation associated with water crossing structures and other development activities will compromise the stability of stream banks and adjacent lands. This again, increases erosion and sedimentation potential around water bodies.

The effects of sedimentation on aquatic life has been well documented (i.e. Newcombe and MacDonald 1991; Ward 1992; Waters 1995; Osterling *et al.* 2010). Sedimentation can negatively alter the aquatic habitat in any water body, and destabilize the existing erosion and sediment transport regimes of watercourses. It has the ability to reduce water clarity, absorb energy from sunlight, and increase turbidity. These effects can reduce the feeding success of sight-feeding fish and invertebrate species, reduce the reproductive success of aquatic species through the loss of nesting habitat and the smothering of eggs, inhibit plant photosynthesis, cause water temperatures to increase, impair respiratory functions, lower tolerance to disease and toxicants and increase physiological stress. Under prolonged conditions where water quality remains at levels unacceptable for aquatic life, death of aquatic organisms may result.

6.2.2.2 Contaminant Spills

Contaminant spills are a concern due to the proximity of construction vehicles and machinery to water bodies. Accidental spills during equipment re-fueling are one of the more frequent spills of concern.

A contaminant spill will result in the degradation of water quality within a water body. Changes in water quality may impose significant behavioral and physiological stress on fish species, resulting in impaired spawning, feeding or routine activities. Under conditions where water quality remains at levels unacceptable for aquatic life, death of aquatic organisms may result. In some case, depending on contaminant physical and chemical properties a spill has potential to result in immediate death of aquatic organisms.

The degree of impact on the water quality and aquatic organisms is dependent on the quantity, chemical composition, and toxicity of the substance spilled, as well as, the spill response time, ability to contain the spill, and dilution capabilities of the receiving water body (flow volume and rate). Watercourses also have the potential to carry hazardous materials for long distances and affect large areas of habitat. The degree to which this impact occurs is directly related to flow within the watercourse. Consequently, deleterious substances will travel a much greater distance in a water body that experiences relatively high flow rates compared to one with standing water. At the same time, higher flows tend to dilute the contaminant, resulting in lower contaminant concentrations.

Ultimately, a release of contaminant or 'spill' into a water body is considered a release of a 'deleterious substance' and is prohibited under the *Fisheries Act*, the *Environmental Protection Act* and *Ontario Water Resources Act*.

6.2.2.3 In-Water Work

Temporary disruption of substrates/habitat is likely to occur at locations where in-water work is required (i.e. underground cabling crossing). Disruption of fish habitat has potential to impair spawning, feeding or routine activities of the resident fish community, more specifically, tolerant warmwater baitfish species. Top predator species and sensitive coldwater species are located within the project area in Adelaide Creek, Ausable River and Lenting Drain, respectively. No in-water work is anticipated to occur in the Ausable River and Lenting Drain, although, underground cabling is required to cross Adelaide Creek. It is recommended that cabling at this location be installed via directional drilling below the creek in order to minimize impacts to the water body.

During in-water work, there is also potential for fish to display avoidance behavior in the actively disturbed area, which can result in the temporary displacement of fish during the construction phase of the project. Fish passage within the channel may also become temporarily (i.e. days) restricted as a result of construction activities, disrupting migration patterns. With the potential for disturbance of sediments, there is an increased risk of sedimentation. Sedimentation is discussed further in Section 6.2.2.1.

The completion of in-water work may also require in-stream dewatering. Prior to dewatering, the work area must first be isolated with the installation of a water containment structure. The structure will be temporary and will form an impermeable diked enclosure, which also prevents escape of debris and sediment to the exterior water body. Impacts associated with the dike structure include the potential for excess sediment to be suspended and carried downstream by stream flow during the installation and removal of the structure. As discussed in Section 6.2.2.1, a release of sediment is considered a release of a deleterious substance and is prohibited. Depending on the size and type of structure utilized, the structure will have direct impacts on the substrates and habitat on which it has been placed, and has potential to strand fish within the enclosure. Impacts associated with dewatering after the water containment structure has been installed are discussed in Section 6.2.2.4.

Impacts associated with the loss or alteration of habitat is dependent on water crossing design structures and is discussed in Section 6.2.1.

6.2.2.4 Dewatering

Minor, isolated, short term dewatering of shallow groundwater may be required for turbine foundation construction. This would be required in areas where the proposed excavation intercepts shallow groundwater table conditions.

Short term, isolated dewatering to remove surface water from work areas as part of a pump and by-pass may also be required during the construction phase of this project where in-water work is required (i.e. installation of road crossing structures) in order to work within dry conditions.

If surface and groundwater dewatering is not managed properly, there is potential for impacts to occur to adjacent and receiving watercourses. Potential impacts to watercourses associated with surface and groundwater dewatering may include:

- **Water Quality Impairment**– dewatered surface or groundwater discharged into nearby watercourses and drainage features that is of a different quality than that of the receiver or is impacted (i.e. high turbidity, temperature differential etc.) has potential to cause immediate impacts on the resident fish population. Changes in water quality may impose significant behavioral and physiological stress on fish species, resulting in impaired spawning, feeding or routine activities. Under prolonged conditions where water quality remains at levels unacceptable for aquatic life, death of aquatic organisms may result.
- **Water Level Alterations** – localized temporary drawdown of the groundwater table has potential to temporarily reduce or eliminate groundwater baseflow contributions to adjacent water bodies that are located within the zone of influence (ZOI). Potential impacts resulting from a loss of baseflow to a watercourse include decreased flow, the temporary restriction of fish passage, increased stream temperatures and decreased water quality. Potential impacts resulting from dewatering surface water from portions of a watercourse include the temporary restriction of fish passage and habitat loss within the dewatered area. Although dewatering activities would only occur for the duration of turbine foundation construction (approximately 4 months) or until groundwater levels receded to a suitable depth, a measurable change in local groundwater flow levels within the ZOI has potential to extend a duration of 7 months, with 4 months of drawdown from dewatering and an additional 3 months where the groundwater table levels will be recovering to pre-dewatering levels.

- **Stream Erosion & Sedimentation** - discharges to watercourses from temporary groundwater dewatering have potential to cause streambed and/or bank erosion and downstream sedimentation if not managed properly. The level of risk for impacts is associated with the volume of water required to be dewatered.

6.2.2.5 Soil Compaction

Heavy equipment and machinery frequently traveling over soils during construction has potential to result in soil compaction. The risk for soil compaction is greater during wet periods when soils are saturated. Soil compaction decreases soil permeability and interferes with surface and subsurface drainage, resulting in an increase in the ratio of runoff to infiltration. If soils are compacted to where runoff approaches 100%, they may act as an impervious surface. Percent impervious cover in a respective watershed leads to water quality/quantity/habitat degradation, if it exceeds a certain threshold (Stanfield and Kilgour 2006). Compacted soil may also restrict the re-colonization of vegetation, and thus contribute to increased potential for erosion and sedimentation as discussed in Section 6.2.2.1.

6.2.2.6 Construction Debris

Stockpiling of construction related materials in or near a water body has potential to enter a water body, if not properly contained. This also includes vegetative debris (i.e. shrubs, tree root wads etc.) left from clearing and grubbing activities. Debris entering a water body has potential to result in the destruction or disturbance of fish habitat, disrupt flow patterns, increasing risk for flooding or erosion and sedimentation, as well as impair water quality. The degree of impact on the water body is dependent on the type of material as well as amount entering the watercourse.

6.2.2.7 Drilling

Directional drilling will be required in a single location to install electrical collector cabling underneath natural features such as watercourses and woodland features. Additional water body crossing locations will likely be added during the permitting and approvals phase of the project. A specific recommended location for drilling includes the crossing at Adelaide Creek. Use of directional drill technology will result in minimal impacts to water bodies in comparison to open trench construction. Although, there are still risks associated with this technique, such as the potential for drilling mud to escape into the environment. This is typically as a result of spill, tunnel collapse or rupture of mud to the surface, which is otherwise commonly known as a 'frac-out'. A frac-out is caused when excessive drilling pressure results in drilling mud propagating toward the surface (DFO 2007). Directional drilling may also result in increased risk of erosion and sedimentation from equipment if located near a water body. In addition, the potential for impairment of water quality from debris or drilling mud (bentonite and water slurry) entering a watercourse is present.

6.2.3 Operation

During the operation phase of the project, it is anticipated that impacts to water bodies will be limited and associated with increased traffic access within the project area as well as ongoing maintenance activities. This includes a risk of contaminant spills, and erosion and sedimentation from maintenance activities (i.e. removal of vegetation). All result in the degradation of surface water quality within receiving water bodies. Contaminant spills are discussed further in Section 6.2.2.2. Erosion and sedimentation is discussed further in Section 6.2.2.1.

6.2.4 Decommissioning

The decommissioning phase impacts are essentially the same as the construction-phase impacts, albeit to a lesser extent due of the lack of removal of water body crossings since access roads will likely remain at most locations. As these impacts are redundant with the construction-phase impacts, they will not be reiterated here. See Section 6.2.2.

6.3 Site Specific Water Body Impacts

In accordance with the Renewable Energy Approval (REA), the proposed Adelaide Wind Energy Centre project area has been assessed for the presence of water bodies by NRSI biologists through the completion of a records review and site investigations. Identified water bodies located within 120m of the project location were further evaluated for potential impacts as it relates to the proposed undertaking. General project phase impacts are discussed in Section 6.2., site specific impacts to identified water bodies are discussed below.

For the purposes of this report, the analysis of potential impacts has been divided by water body type, as defined by the REA regulation. This includes permanent/intermittent watercourses (crossings, within 30m, and within 120m).

A total of 23 water body features were identified within the project area. All of which have been identified as intermittent/permanent watercourses. There are a total of 37 individual locations where these 23 water bodies are present within 120m of the Adelaide project location. No lakes, Lake Trout lakes or seepage areas were identified within the Adelaide Wind Energy Centre project area.

The following section outlines potential site specific impacts on water bodies associated with the proposed Adelaide Wind Energy Centre.

6.3.1 Intermittent/Permanent Watercourses

A total of 23 intermittent/permanent water bodies have been identified within the Adelaide Wind Energy Centre project area. These water bodies provide habitat for fish and other aquatic organisms and must be given consideration in order to protect them from immediate or prolonged degradation.

NRSI has identified that 19 water bodies will be crossed at 26 specific crossing locations (individual water bodies may be crossed at several locations). Each of these 26 crossing locations includes the crossing by at least one project component, but typically multiple project components (i.e. access road and underground cabling). Each of these individual crossing locations has been summarized in **Error! Reference source not found.** below.

Table 3. Summary of Intermittent/Permanent Watercourse Crossing Locations, Site Specific Considerations & Potential Impacts

Drainage Area	Water Body Feature name	Water Body Location ID	Crossing Infrastructure	Site Specific Considerations	Potential Impacts
Ausable River	Ausable River	WB41	• overhead cabling • construction area	moderate sensitivity fish habitat, top predator species	outlined in Section 6.2., in-water work and

Drainage Area	Water Body Feature name	Water Body Location ID	Crossing Infrastructure	Site Specific Considerations	Potential Impacts
Adelaide Creek	Adelaide Creek	WB59	• overhead cabling • construction area	present, no in-water work or drilling with overhead cabling	drilling does not apply as cabling will be installed overhead
		WB60	• overhead cabling • construction area		
		WB34	• underground cabling • construction area	moderate sensitivity fish habitat, top predator species present, in-water work may apply if open trench construction is proposed	outlined in Section 6.2.
	Tributary E	WB33	• underground cabling • construction area	low sensitivity fish habitat, tolerant baitfish species present, in-water work may apply if open trench construction is proposed	
	Cleland Drain	WB2	• underground cabling • construction area		
	Wilson Drain	WB4	• underground cabling • construction area		
	Morgan Drain Branch A	WB14	• underground cabling • construction area		
	Down Drain	WB18	• underground cabling • construction area		
Adelaide Creek	Seeds Drain	WB30	• underground cabling • construction area	low sensitivity fish habitat, tolerant baitfish species present, in-water work may apply if open trench construction is proposed	outlined in Section 6.2.
Mud Creek	Dodman's Drain	WB21	• underground cabling • construction area		

Drainage Area	Water Body Feature name	Water Body Location ID	Crossing Infrastructure	Site Specific Considerations	Potential Impacts
		WB22	• underground cabling • construction area		
		WB39	• underground cabling • construction area		
	Walker Drain	WB23	• underground cabling • construction area		
	Sutherland Drain	WB24	• underground cabling • construction area		
Lenting Drain	Lenting Drain	WB42	• overhead cabling • construction area	high sensitivity fish habitat, sensitive coldwater species (salmonids) present, no in-water work or drilling with overhead cabling	outlined in Section 6.2., risk of impacts to sensitive coldwater species, in-water work and drilling does not apply as cabling will be installed overhead
		WB10	• overhead cabling • construction area		
		WB11	• overhead cabling • construction area		
Big Swamp Drain	Big Swamp Drain	WB97	• overhead cabling • construction area	low sensitivity fish habitat, generally tolerant baitfish species present, no in-water work or drilling with overhead cabling	outlined in Section 6.2., in-water work and drilling does not apply as cabling will be installed overhead
Ptsebe Creek	Tributary A	WB65	• overhead cabling • construction area	low sensitivity fish habitat, generally tolerant baitfish species present, no in-water work or drilling with overhead cabling	outlined in Section 6.2., in-water work and drilling does not apply as cabling will be installed
	Tributary D	WB79	• overhead cabling • construction area		